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Contents

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Publications Received

Accuracy of Hydrographic Surveying in and near the Surf Zone. Beach Erosion Board. Technical Memorandum No. 32. Washington, D.C.: Department of the Army, Corps of Engineers, 1953. 28 pp.

Alameda County Mosquito Abatement District. Annual Report, 1952. Oakland, Calif.: Alameda County, 1953. 20 pp. Illus.

Annual Epidemiological and Vital Statistics, 1950. Pt. 1, Vital Statistics and Causes of Death. Geneva: World Health Organization, 1953. 371 pp. $5.00.

Bibliography of Electromigration in Stabilized Electrolytes. Hugh J. McDonald. Chicago: Precision Scientific Co., 1953. 8 pp. Mimeo. Free.

Bibliography on Southwestern Asia. Henry Field. Coral Gables, Fla.: University of Miami Press, 1953. 106 pp.

Bridging the Gap between School and College. Evaluation Report No. 1. New York: Fund for the Advancement of Education, 1953. 127 pp.

The Bulletin of the Beach Erosion Board. Special Issue No. 2. Shore Protection Planning and Design. Washington 25, D.C.: Department of the Army, Corps of Engineers, 1953. 230 pp. + appendices. Illus.

A Catalogue and Historical Account of the Sloane Shell Collection. Guy L. Wilkins. Bulletin of the British Museum (Natural History), Historical Series, Vol. 1, No. 1. London: British Museum, 1953. 47 pp. + plates. 16s.

The Chemical Industry. Facts Book. Washington, D.C.: Manufacturing Chemists' Association, Inc., 1953. 108 pp. Illus. $1.00.

Chemical Investigations of the Tobacco Plant, IX. The Effect of Curing and of Fermentation on the Composition of the Leaves. Bull. 569. Hubert B. Vickery and Alfred N. Meiss. New Haven, Conn.: Connecticut Agricultural Experiment Station, 1953. 125 pp.

Coletânea de Trabalhos do Instituto Butantan. Vol. III, 1951–52. São Paulo, Brazil: Instituto Butantan, 1952. 75 pp.

Common Ocean Fishes of the California Coast. Phil M. Roedel. Sacramento, Calif.: Department of Fish and Game, 1953. 184 pp. Illus.

East Malling Research Station near Maidstone, Kent. Annual Report 1952. Maidstone, Kent: Research Station, 1953. 190 pp. Illus. 12s. 6d., or $2.00. U.S.

Expert Committee on Venereal Infections and Treponematoses. Fourth Report. WHO Technical Report Series No. 63. Geneva: World Health Organization, 1953. 65 pp. + plates. 55¢.

Field Crop Abstracts. Compiled from World Literature. Vol. 6, No. 2. Abs. 456–846. Farnham Royal, England: Commonwealth Bureau of Pastures and Field Crops, Aberystwyth, 1953. 75 pp.

First International Symposium on Yaws Control. Bangkok, 1952. WHO Monograph Series No. 15. Geneva: World Health Organization, 1953. 392 pp. + plates. $4.50.

Herbage Abstracts. Compiled from World Literature. Vol. 23, No. 1, Abs. 1–285. Farnham Royal, England: Commonwealth Bureau of Pastures and Field Crops, Aberystwyth, 1953. 72 pp.

Home Shelters for Family Protection in an Atomic Attack. United States Civil Defense. Technical Manual 5–5. Washington, D.C.: Government Printing Office, 1953. 86 pp. Illus. 30¢.

Survey of Physiological Science

THE Survey of Physiological Science, under the sponsorship of the American Physiological Society and operating through a National Science Foundation contract, is measuring the present status of physiology and physiologists. By comparing the present position of the science and its people with the past, the Survey hopes to provide data upon which valid predictions for the future may be based.

The effort of the Survey includes all the physiological sciences, whether in botany, psychology, bacteriology, or zoology, and is concerned alike with the basic sciences, as well as their applications to medicine, agriculture, industry, and other scientific disciplines.

Problems in physiological education, research, application, and administration are considered to be the actual working aspects of the science. The techniques to be used include comprehensive questionnaires which will be sent to a representative number of physiological scientists whose names will be drawn from established rosters and institutional sources. These scientists will be found in a representative sample of academic, clinical, government, and industrial institutions taken from a composite list recently made up by the Survey. Not only will personal interviews be conducted with a small group from the sample, but it is hoped that regional seminars eventually can be arranged to discuss ways and means of dealing with the problems that are brought out during the course of the Survey.

A comprehensive study of the physiology literature is being initiated and will concern itself with the quality, quantity, and efficiency of the present literature as a storehouse of physiological knowledge and as a form of communication.

College catalogue surveys, public attitudes toward physiology, professional potentialities, secondary school education in dynamic biology, special applications of physiology, and trends and perspectives of contemporary physiology as seen through the eyes of American and foreign physiologists are some of the special projects in progress.

The operations of the Survey, centered in Washington under the immediate supervision of an Executive Director, has the constant advantage of frequent critical scrutiny of a Central Committee composed of acknowledged leaders in animal, plant, and bacteriological physiology.

Frequent meetings of the committee, together with the constantly available advice from a number of special authorities and organizations acting as Subcommittees or separate consultants, and from other scientific surveys, ensure the validity and comprehensiveness of a project sure to affect vitally the future of physiology in this country.

L. M. N. BACH, *Executive Director*
Survey of Physiological Science

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Meetings & Conferences

Aug. 3–5. Abnormal and Pathological Plant Growth. Brookhaven National Laboratory, Upton, L. I., N. Y.

Aug. 3–8. 4th International Astronautical Congress. Zurich, Switzerland.

Aug. 3–8. World Meteorological Organization, Regional Assoc. for North and Central America, First Session. Toronto, Canada.

Aug. 4–8. Photographic Society of America. Los Angeles, Calif.

Aug. 4–12. 7th International Congress for the History of Science and 3rd General Assembly of International Union for the History of Science.

Aug. 5. Symposium on Macromolecules. Uppsala, Sweden.

Aug. 5–12. International Congress of Zoology. Copenhagen.

Aug. 7–8. Pennsylvania Academy of Science (Summer). Thiel College, Greenville, Pa.

Aug. 9. International Veterinary Congress (15th). Stockholm.

Aug. 10–14. Society of American Bacteriologists (Annual). San Francisco.

Aug. 10–18. American Association of Colleges of Pharmacy (Annual). Salt Lake City, Utah.

Aug. 11–13. International Atomic Power Congress. Kjeller, Norway.

Aug. 11–14. Canadian Teachers Federation, Alpine Inn, Ste. Marguerite, Quebec, Canada.

Aug. 12–18. International Congress on Home Economics (8th). Edinburgh, Scotland.

Aug. 15–30. Summer Seminar Workshop in General Semantics (10th). Institute of General Semantics, Lakeville, Conn.

Aug. 16–21. Third International Congress of Electroencephalography and Clinical Neurophysiology. Radcliffe College, Cambridge, Mass.

Aug. 16–22. American Pharmaceutical Association. Salt Lake City.

Aug. 16–22. American College of Apothecaries. Hotel Utah, Salt Lake City, Utah.

Aug. 16–22. American Society of Hospital Pharmacists. Salt Lake City. Utah.

Aug. 16–26. International Conference on Soil Mechanics and Foundation Engineering (3rd). Zurich and Lausanne, Switzerland.

Aug. 18–21. American Institute of Electrical Engineers (Pacific General). Vancouver, B. C.

Aug. 18–21. International Union of Biological Sciences (11th General Assembly). Nice, France.

Aug. 18–21. Pi Lambda Theta (18th Biennial Council Meeting). University of New Mexico, Albuquerque, N. M.

Aug. 19–21. Western Electronic Show and Convention, San Francisco Civic Auditorium, San Francisco, Calif.

Aug. 20–26. Congrès International de Philosophie. Brussels.

Aug. 20–30. International Congress of Limnology (12th). Cambridge, England.

Aug. 22–25. Joint Commission on High Altitude Research Stations. Boulder, Colo.

Aug. 23–28. American Dietetic Association. Los Angeles, Calif.

Aug. 24–28. International Congress of Rheumatic Diseases. Geneva, Switzerland.

Sept. 28–Oct. 2. Fourth Alaskan Science Conference, sponsored by AAAS, Alaska Division, Juneau.

Education in the Shadow of the Iron Curtain[1]

Wolfgang O. L. Heubner[2]
Free University of Berlin, Berlin, Germany

THE UNIVERSITY OF BERLIN, one of the youngest in Germany, was founded in 1810 through the efforts of Wilhelm von Humboldt. For 123 years, through changing times and political upheavals, it fulfilled its task with success and dignity. In 1932 I went to Berlin from Heidelberg and thus had occasion to witness the last year of its full and untrammeled activities.

When the National Socialist party came into power in Germany in 1933, the University of Berlin lost many outstanding faculty members. Unfortunately, too, part of the faculty and student body strayed from the academic fold.

The University ceased functioning in the spring of 1945 with the collapse of the Nazi system itself. Because of persistent air attacks we were not able to carry on any teaching during that year. There were hardly any students; buildings had disappeared; there was no water, gas, or electricity. I was forced to abandon work in my fairly well-preserved department for nearly a year. In January of 1946 the occupation forces allowed my return, just in time for the opening of the school by the Russian forces.

Obviously the name of the institution had to be changed. The new administrators—sworn Communists—emphasized that this was not to be a reopening of an old, but the formation of a new, school. First it was called Linden University after the street on which it is located; later the name was changed to Humboldt University, after its founder.

For three years, as Dean of the Medical Faculty, I had opportunity to observe at very close range the organization, as well as the spiritual structure, of this university and the changes and disturbances that occurred. It became evident very soon that the Russians would not tolerate the University as a school of higher learning for its own sake; they would use it as a place for education of "specialists" who would serve, through their knowledge, the advancement of the "working" people. Subjects like religion, law, history, Greek, and Latin became superfluous. Russian and other Slavic languages took preference over others (at the high school level English disappeared entirely). In the biological sciences, especially in genetics, the teachings of such men as Mendel, Correns, and Morgan had to be abandoned. However, the study of pedagogy, physics, chemistry, medicine, and agriculture were greatly encouraged because they obviously could benefit the working population.

Regulations and policies regarding admission to the University were altered. Children of factory workers and small farmers received preference over the sons and daughters of lawyers, doctors, teachers, and ministers. This often led to misstatements on the questionnaires: students applying gave their fathers' profession simply as "laborer," if they were formerly professional men now compelled to perform manual labor for a certain period because of participation in the Nazi party.

For members of the low income groups special preparatory courses were instituted wherein the talented student could acquire some sort of high school training in about a year and a half. Many of the more intelligent ones succeeded, but there were some who could not attain the desired level in such a short time. Unfortunately it became my duty as dean to refuse admission to students without sufficient preparation. Sometimes, when my conscience did not permit me to accept a student on the results of the matriculation examination, the Communist Ministry of Education reversed my decision. This situation led to my resigning my position as dean.

On the whole, teachers in any of the accepted subjects were well treated; they received sufficient salary and the so-called "Pajoks"—monthly packages of meat, sugar, butter, potatoes, some coffee, and Russian cigarettes—in those days items valued higher than money. Teachers were also granted admission to certain cultural clubs where journalists, politicians, artists, actors, and professors could receive meals without surrendering ration tickets. This attitude was impressive. For a while it looked as if we in certain professions might hope for recovery from our fourteen years of degradation. However, we were soon to experience pressure directed against another part of our University, the student body.

At first the students relieved from military and Nazi party discipline were organized freely and according to their own inclinations. Soon, however, their elected officers were relieved, and indoctrinated pro-Communist enthusiasts were substituted.

The first victim of this regime was Gerhard Wradzidlo, a medical student and leader of the first student organization after the war. In March of 1947 he was arrested because he opposed attempts of the Communists to exert influence on the University and raised particular protests against the adorning of the old buildings of Berlin University with Communist emblems. One day he received a telephone call, ostensibly from a friend awaiting him in a cafe. Only policemen and soldiers awaited him. In the Russian

[1] An address presented at the University of Illinois College of Medicine, Chicago, on October 1, 1952.

[2] Dr. Heubner, Professor of Pharmacology at the Free University of Berlin, was dean of its Medical Faculty from 1950 to 1952.

Occupation Zone he was sentenced to 25 years in prison.

Similar cases in other universities also aroused the students in Berlin. In Jena in 1948, the election of five members of the student body was not confirmed by the occupation forces, and they were replaced by students who were more compliant with the wishes of the government.

As late as March 1948, the members of the student council in Berlin were ordered to a conference with Professor Solotuchin, the Chief of the People's Culture Division of the Soviet Military Administration. At this conference the professor deplored the study of "foreign" cultures by the Berlin students and recommended instead the study of Communism. Later, disciplinary proceedings were instituted against these council members because they had called a student assembly in the British sector of Berlin (no decision was reached in the case).

The spying on students and betrayal by their colleagues and the feelings that permeated the lives of the students are best reported in the words of a medical student:

"It all started during a meeting of the German Social Democratic Party during the election campaign in Berlin in 1948. The meeting was held in Zehlendorf, in the U. S. sector, but the Communists had sent a delegation of their own: young men with wild hair, dressed in windbreakers, who tried to break up the assembly by singing and chanting. The reaction of the audience was as much against the oppressors of Berlin as against the actual disturbance, and the disturbers of the peace were driven from the hall —not without the use of some force by some of us.

"At that time I was studying at the Humboldt University. A few weeks after the meeting I have mentioned I was sitting in the University dining hall: a great dark room with shored-up walls and windows repaired with cardboard. Pale, poorly clothed students ate their soup, after presenting their ration cards. I noticed suddenly that several students at another table were watching me; I seemed to recognize their faces—then I knew: they had belonged to the group of hecklers at the meeting in Zehlendorf. I grew uneasy; my skill with my fists might mark me, as an opponent of the Soviet regime, for several years of forced labor. I got up quickly and left the dining room with my heart pounding.

"A few days later a friend approached as I was working in the anatomy laboratory and said, 'There are three men outside; they want to talk to you.' I knew immediately what his words meant. I thought of the possibilities of escape: there was only one exit and I couldn't jump from a third story window. So I went down—my mouth dry, my heart pounding, and with a feeling in the pit of my stomach that made me know the meaning of 'hypochondria.' I was horribly afraid but sure it couldn't be that this was happening to me; it was like one of those dreams in which one knows one is dreaming. They were standing in the entrance hall: a lean, little man with sneering features and two big 'bulls' with blunt, brutal faces—the usual SS or GPU types. The little one came up to me and said with exaggerated politeness: 'Have I the honor to speak to Herr R.? Unfortunately we must ask you to come with us. We'd like you to identify a certain K.' I answered that I had never heard the name before. 'Certainly, but he makes precise reference to you and we have to prove it just as precisely.' I objected that I was extremely busy and would prefer to testify the following day. 'No, the business is pressing. You must come immediately, but it won't take much of your time.' During this exchange my brain was working feverishly: three men coming to get me to make a deposition? Highly improbable. It is a typical NKVD method not to give the reason for an arrest, but always to talk of a short, harmless conversation. These 'conversations' frequently lasted several years. There was only one thing to be done, fly!—quickly!—anywhere! I gave the little one the dissecting kit which I still held in my hand and said: 'Hold this a minute; I have to sign out before I can go with you.' I ran down the steps and out of the building, with one of the officials right behind me, guarding me. As soon as I got into the open I began to run as fast as I could. I glanced behind me to see the officer staring after me, speechless, and then signaling with his whistle. I paid no attention but ran as fast as I could through the crooked streets and passages of this old part of Berlin. Stalin looked down on me from the Russian headquarters; the words on the sign said: 'Praise to the great Stalin, savior of the people.' A Russian sentry gazed in astonishment at the sight of a young man in a white coat and rubber apron running past him. Every few minutes I looked behind me to see if I was being followed. Every automobile seemed to contain my pursuers, and I waited for each to pull up beside me, but they all drove past. Ahead of me I saw the Sandkrug bridge, end of the 'democratic' sector. Two of the People's police were checking the papers of a lorry and paid no attention to me. I ran over the bridge. Panting, with a racing heart, I sat on a curbstone, safe in the British sector."

More and more, the dissatisfaction and apprehension among a large part of the student body became outspoken. With their experience of military service, war imprisonment, extreme hardship and deprivation of the postwar years, these men and women knew what they wanted. Most of them had lost a number of years of their lives and were anxious to finish their studies. They had had enough pressure and regimentation, and, although their physical resistance might not have been great, they were vocal and they made themselves heard.

In their newspaper, *Colloquium*, they branded and ridiculed conditions at Linden University and made them widely known to the public, to the dissatisfaction of the Russian occupational administrators. Finally, during the winter of 1947–48, the three re-

sponsible student editors and writers of the paper, Otto Hess, a medical student, Joachim Schwarz, a law student, and Otto Stolz, a student of political science, were dismissed from the University by decree of the educational administrator of the German Soviet Zone, Paul Wandel. In vain the University Senate protested the illegal dismissal of the students. This disciplinary action of the Minister created a great storm among the students. Soon voices were heard saying that a new and different University was necessary. Many well-attended meetings were held by the students, not in the Soviet section of Berlin because they were forbidden there, but in the western part of the city, mostly around Dahlem, in the American sector. With the encouragement of officials—the mayor of Berlin, Ernst Reuter; the art historian, Edwin Redslob; many professors; and, last but not least, the American General Howley—a decision was reached in the summer of 1948: a new "Free University of Berlin" was to be founded.

Within a few months a skeleton staff of teachers was hired, buildings were evacuated by the American forces in Dahlem, and a large hospital in the British sector of West Berlin was designated as the University teaching hospital. In November 1948, the opening of the new Free University of Berlin was celebrated. At the opening General Howley and Thornton Wilder made excellent and significant addresses.

In all these efforts—administrative discussions, correspondence, difficult and often secret communications between the eastern and western sectors of Berlin, and the sheer manual labor of preparing classrooms, furniture, bookcases—the enthusiasm of the students carried the project along and led toward final success.

The first president—or as we call it "Rector"—of the Free University was the eminent historian Fredrick Meinecke, then 86 years old. Although, because of his age, he had been professor emeritus for a number of years, he consented to take the honorary presidency but left the administrative responsibilities to Edwin Redslob, his successor in office.

At the time of the opening of the Free University I was still a member of the faculty of Humboldt University, in the Russian sector. However, since the bombardments, our laboratories and experimental stations had been housed in Dahlem, in the American sector, in one of the buildings of the former Kaiser Wilhelm Gesellschaft. I asked for, and promptly received, release from Humboldt University in March of 1949. During these months, the friction and repeated incidents between Russian and American occupational forces prompted General Howley to decree that all Humboldt University property in the western sector be incorporated into West Berlin teaching institutions. Thus it became possible for us in the pharmacology department, housed as we were in Dahlem, to transfer immediately, without having to move personnel or equipment, to the Free University of Berlin.

I received the offer to serve as head of the pharmacology department in May, 1949. Although I had doubts about accepting another call at the age of 72, I have since served another 3½ years in teaching and research. Therefore, after very close and careful observation, I can relate some of our experiences at the Free University of West Berlin.

From the history of its foundation, it is evident that the student body has taken a very special part in the function of the University, at least as compared to other German universities. The students were the ones who were exposed to Russian methods first, and therefore, acting in solidarity with their fellows and reacting most violently against those methods, they became most vocal in calling for a new school.

Members of the first classes of students, some of whom have graduated and serve as instructors, consider the Free University *their* creation. They have, therefore, received and accepted considerable rights in the administration of the school. In this way there was created a spirit of cooperation between the oldest professor and the youngest student. After 44 years of uninterrupted teaching, this spirit has contributed tremendously to the enrichment of my life. Perhaps to you in the United States there is nothing new about this, but we in Germany are enjoying such fraternity for the first time at the Free University of Berlin. We have student participation on all committees and administrative bodies; the students have a voice (and very often excellent judgment) in admissions to the school. On the other hand, the faculty is always invited, although not always present, to attend their meetings, discussions, and social gatherings. It happens that one of their meeting places is right across from my house. Thus, I may even be called upon somewhat more frequently than others, occasionally even at times not too convenient. However, contact with youth exerts the same influence on age as the earth had upon Antaeus; some of the girl students are very pretty, as even baldness and white hair will admit.

I would not have wanted to miss these years of close cooperation with the student body. The friendships that have developed on this basis will certainly last longer than my lifetime, because these experiences are by no means mine alone.

In respect to our actual work, the teaching and learning process, we are far from being in a desirable position. In Berlin we are living on an island of the Western World surrounded by high and threatening seas. The significance of this is recognized, but its impact can be fully understood only through day-to-day living. Every morning we become aware anew that only the ready and determined preparedness of the Western powers is the dam which prevents our island from becoming completely engulfed. Let us not forget, however, that in the area around our island, in the Russian Zone, there live thousands of people, suppressed and often threatened. Daily, over a period of years, there has been a stream of people entering Berlin, more than one thousand a day during the last few months. They come empty-handed, in need of money, clothing, work, and housing. The citizens of

Berlin, hard-working and persevering as they may be, are unable to cope with this endless river of misery and want. Although there are public funds for the expensive and often dangerous air transportation of these refugees into the western part of Germany, the waiting period in Berlin is costly and tedious, and often long.

The burden of refugees and unemployed upon the budget of the city is reflected at the University in decreased funds for scientific books, supplies, and apparatus. West Berlin supports the University by tax money. We are profoundly grateful for the many and magnanimous donations, above all of books and expensive apparatus, which American philanthropy has sent us through both private and official channels.

There are many students among the refugees from Eastern Zone. They come with hope and great expectations because they know that the Free University was created for those who want to study as free men and not under the yoke of a doctrine. Of course, we cannot admit all of them; their number is far too great, and we have to insist on the same scholastic standards for applicants from both East and West Berlin. It is often heart-rending to see the plight of these hopeful young men and not be able to help them. I remember many penniless students who had walked long distances to escape from the East. I have had to give them money to make a phone call to friends, to be able to ride the streetcar or to buy bread. Most of our students have no support from their parents, but are forced to apply for scholarships, to work part-time, or both. I understand that many of the American students support themselves. However, it is infinitely more difficult for a student in Berlin to find part-time work with decent pay. Harassed by worry about his daily bread, he has too little time for study and too little money for buying books. He also suffers from a mediocre and deficient grammar school and high school training. The level of such training was deplorably low under the Hitler regime, and it can be improved only gradually because good teachers are scarce. In spite of all this, the average scholastic achievements of our students are satisfactory. Performances of the best students of the class appear, fortunately, to be comparable to those in former classes.

Interest in science is lively, although often overshadowed by worry about the future. It is my impression that, compared to the ground swell of optimism I find in America, the attitude of our students toward their future is often pessimistic. Therefore, quite a few young men, often the most promising, wish to emigrate, especially to America, where they hope to find better opportunities. Apart from practical reasons, the interest in the countries of the Western World, in their people, and their ways of living is great. Every opportunity to meet with foreign students and visitors from the West is eagerly sought. Foreign visitors, students and professors alike, are welcomed and invited to discussion groups whenever it is possible. This constitutes a sharp reversal from the days of Hitler's propaganda, which antagonized and defamed everything originating outside Germany. It has become only too clear, how false and irrational his insularity and chauvinism were.

The Free University does not tolerate anti-Semitic tendencies. Occasionally one hears mention of a revival of anti-Semitism in West Germany. I have not seen evidence of it. I know for certain that our University views with suspicion anyone with anti-Semitic attitudes. Jewish men and women take an equal and successful part in the leadership of the student organizations.

Our students have actively resisted all attempts to reintroduce the dueling organizations. Regulations of the Free University expressly forbid the revival of such long-outmoded customs, although the students have the democratic right and privilege to organize clubs and athletic activities of all other kinds. I am confident that professors and students at Berlin will maintain a clearly progressive attitude and resist any reversion to undemocratic customs.

Naturally, it is a great help to all of us to see that large parts of this earth are ruled by tolerance and love of freedom. This explains my happiness in speaking to our American colleagues, to whom we of the Free University of Berlin feel akin.

Those Flying Saucers

C. C. Wylie

Department of Mathematics and Astronomy, State University of Iowa, Iowa City

RECENT articles on saucers (SCIENCE, 116, 640, 693 [1952], *Griffith Observer,* XVI, 138 [1952]) fail to mention the fact that a satisfactory explanation for the original and typical saucer was published soon after the first reports were given prominence in the press, and again at later times. The new book debunking the saucer stories (*Flying Saucers,* vii, by Donald H. Menzel, 1953) includes "distant planes, jet aircraft" in a list of material objects responsible for saucer reports, but the list includes objects which do not produce the typical saucer and have never been reported to me as saucers.

The typical saucer is seen only on clear days and has the appearance of a round or oval disk of bright aluminum. Perhaps the most widely circulated of the

early explanations was that of the late Howard W. Blakeslee, Science Editor of the Associated Press. He wrote that he and others had seen airplanes, in reflecting the light of the sun, produce perfect saucers, with no sign of the outline of the plane showing.

As my research work on spectacular meteors depends on reports from the general public, I have received dozens of reports on flying saucers and strange lights. The bright silvery disk is always called a "saucer." The use of the word saucer for any other "strange light" or object in the sky is rare.

In the summer of 1948, I saw a group of conspicuous saucers, and verified that they were produced by metal planes by driving toward them. Persons reporting to me have found the saucers were produced by planes by driving toward them as I did, or occasionally by using binoculars. Another check which I have made is to call the airport when the saucer is seen, and verify that a plane is maneuvering in that area. A few saucers reported to me have been produced by birds. The glistening white breast of a hawk seen from the critical angle with the sun may shine as a "saucer" when flying, or as a "tin can" when the bird is sitting on a post. It should be noted that a plane may be quite close enough to be seen as a plane and heard, and yet suddenly become a "saucer" with a change in direction of travel. A hawk may be easily recognized with the naked eye, and suddenly become a saucer when it changes direction of flight.

As these saucers are simply reflected sunlight, they have the following characteristics: (1) they are seen only when the sun is shining ;(2) they are generally seen in the part of the sky opposite the sun; (3) there is only one sighting on each saucer, as the area for the critical angle is small; and (4) the saucer may disappear suddenly when the plane turns: it may reappear again at a different level.

The fact that I receive scores, even hundreds of reports on a bright meteor, but only one on a saucer, shows in itself that the saucers are not space ships, enemy projectiles, or secret weapons, but only spots of reflected light seen from the critical angle.

Turning to the magazine features, we find that, like the reports we receive more directly, there is only one sighting for each saucer. This means that figures for distance, height, and speed are mere guesses of no real value. Anyone who has had high school geometry should know this. The featured stories are very similar to those I receive, and I see no reason to doubt that if a trained person had been at hand to obtain promptly the fundamental facts and to discard the imagination and error, a simple explanation would have been found easily.

The various other stories appearing with the saucer features can be treated more briefly, since none of these is ordinarily called a saucer. The first is the fireball, or spectacular meteor, which arouses plenty of interest. I have received over 700 letters on a single fireball. As Otto Struve of the University of California pointed out (*Griffith Observer*, **XVI**, 138 [1952]), green has been and is a common color. Menzel states (*Flying Saucers*, 138, 1953), "In my opinion, any astronomer who avers that green meteors are new, or that the color must come from burning copper, cannot be much of an authority." I received hundreds of reports on green fireballs in 1952 alone. Canadian astronomers are reporting a considerable number of green meteors. An old book on meteors and meteorites shows that the green color was as common eighty years ago as it is now.

I have been called out of bed at 1:30 A.M. to explain that the bright light low in the eastern sky is the planet Jupiter. Questions on planets and bright stars are common. I receive telephone calls, occasionally long distance, and letters on balloons, on haze illuminated by flood lights or airport ceiling lights, and on the planet Venus in daylight, but none of these are reported as saucers.

An interesting report from an aeronautical engineer was that two hazy stars, one above the other, moved across the northern sky from west to east. This was evidently a mirage effect, the reflection in the sky, from a rather sharp temperature inversion layer, of the lights of a car which could not be seen directly. Another report, but from a more imaginative person, was that a brightly lighted ship appeared briefly in the sky. This may have been the inverted reflection of a bus with the interior lights turned on momentarily. Occasionally, on clear moonless nights, when a cold front is moving in, highway patrolmen report seeing what they call "goof lights." These are hazy spots of light that move across the sky with an undulatory motion. The goof lights presumably are mirage reflections from a wavy inversion layer, or layer of light haze.

As to explaining the featured stories, I learned twenty-five years ago that a prompt on-the-spot interview changes such stories surprisingly. The observer will disclaim part of the story, explaining that others added it. He will say that his wife, who was with him, claims another part of the story is imagination. From prompt interviews one gets stories which agree with the well-known laws of nature, but if one waits a year or more, the exaggerations and imagination become fixed in the minds of honest and intelligent people. I could produce from such old stories apparently good evidence for all sorts of violations of the well-known laws of nature.

To show the exaggeration possible in an apparently well-authenticated story, consider the story of the fireballs which appeared over the Regina area of Saskatchewan, Canada, on the evening of February 9, 1913, and moved southeastward across Canada and the United States passing nearly over Winnipeg, Toronto, and other important cities including New York City, thrilling and startling thousands of persons in the United States and Canada. This story has been featured in several recent magazine articles, for example, giving the number of fireballs passing along that path as 200 to 400 (*Coronet*, **XXXIII**, No. 5,

131–132 [1953]) and stating that if the fireballs had come to earth earlier, instead of plunging into the Atlantic Ocean, they would have spread fire and flame over the densely populated area between New York City and Philadelphia.

The original reports are available on this display and they show that only one real fireball appeared along that path over North America at that time. The fireball was not very large, as it disintegrated at a height of twenty-five miles near Hamilton, Ontario. This fireball and associated shooting stars attracted considerable attention in the Toronto area of Canada, but they were not travelling horizontally. They were falling downward at an angle of twenty degrees, and they were not travelling in the direction of New York City. The horizontal motion was in the general direction of Washington, D. C., rather than toward New York City. Obviously what really happened was a shower of shooting stars which was exceptionally good in the Toronto area, but attracted relatively little attention elsewhere. The only report from the densely populated New York City area was from a lady who watched the sky for a while and counted seven shooting stars. The popular story is impossible, of course; and it is evident that an excellent but unpredicted shower of shooting stars has been "blown up" into a marvelous procession of fireballs.

Because of the presence of exaggeration and error, and the absence of essential facts, in older reports I have made little attempt to investigate any reports of saucers, strange lights, or objects in the sky except when they are reported promptly, usually by telephone. For these I have found it not difficult to eliminate the imagination, obtain the essential facts, and offer an explanation which is certainly or probably true. I have always assumed that the older reports I receive, and the stories featured in the magazines could be explained as easily if one had the essential facts, freed from imagination and error. This is borne out by the new book *Flying Saucers*, previously referred to, in which a reasonable explanation is offered by Menzel for the more sensational of the stories featured by those who are trying to make a case for interplanetary space ships.

News and Notes

Meeting of the American Meteorological Society

THE 122nd National Meeting of the American Meteorological Society, which convened in Washington, D. C., on April 29, was the largest in terms of total number of registrants in the thirty-four year history of that organization. Joint sessions with the American Geophysical Union on May 4 and with the American Physical Society on May 2 undoubtedly helped to swell the total registration, which reached 516. There were many registrants from foreign countries whose governments had sent delegates to the first (April, 1953) session of the Commission on Synoptic Meteorology of the World Meteorological Organization. The latter sessions terminated in Washington on April 29, permitting many of the delegates to attend the A. M. S. meeting prior to departing for their homelands.

Highlight of the A. M. S. technical sessions was a panel discussion on the "Jet Stream," with Brig. Gen. J. J. George of Eastern Airlines as Moderator. The current status of exploration of the jet stream and of research into the causes of this phenomenon and its greater utilization in weather forecasting were discussed by researchers representing the Air Force, the Navy, the Weather Bureau, the University of Chicago, and the Canadian Meteorological Service. At an evening session devoted to the rapidly growing field of radar meteorology the first known radar photographs of a tornado vortex were described by G. E. Stout of the Illinois State Water Survey. Guest speaker at the annual Spring Dinner at the National Press Club on April 30 was George Gamow, who addressed the 272 members and guests of the American Meteorological Society on the subject "Cosmic Weather."

CONRAD P. MOOK, *General Chairman of Meeting*

U. S. Weather Bureau Consolidated Forecast Center
Washington National Airport
Washington, D. C.

American Association of Physics Teachers Meeting

THE Summer Meeting of the American Association of Physics Teachers was held June 25–27 at Pittsburgh, chiefly in the auditorium of Mellon Institute. The group was small enough to meet in single sessions and large enough to be stimulating. Parts of several sessions were devoted to short contributed papers on demonstration equipment or specific problems of presentation of pedagogical interest. Dr. R. Sutton stimulated the audience with various ticklish problems entitled "Some Teasers for Conclusion Jumpers." In addition there were four symposia: the relation of physics and medicine, the integration of high school and college level teaching of physics and the difficulty of implementing satisfactory science instruction at the high school level, the problem of the training of the very good student in high school so that he can be exempted from the elementary basic course in physics in college, and the new field of transistor physics. Tours planned for the

members included a visit to Buhl Planetarium and a tour of the synchrocyclotron laboratory of the Carnegie Institute of Technology at Saxonburg.

MILDRED ALLEN

Department of Physics
Mount Holyoke College

Scientists in the News

Professor emeritus status has been conferred on **E. T.Bell,** Professor of Mathematics, and **Paul S. Epstein,** Professor of Theoretical Physics, both of the California Institute of Technology. Dr. Bell joined Caltech's staff in 1926 after fourteen years at the University of Washington. A native of Scotland, he was educated in England, came to this country in 1902, and studied at Stanford University, the University of Washington, and Columbia University, where he was awarded a Ph.D. in 1912. He is well-known for his research in the theory of numbers as well as in other fields of advanced mathematics. He holds the Bocher Prize of the American Mathematical Society and he was elected to the National Academy of Sciences in 1927.

A prolific and versatile writer, Dr. Bell received the Gold Medal of the Commonwealth Club of California in 1938 for his accomplishments in this field. He has published four learned works on mathematics and nearly 300 technical papers. His ten popular books on mathematics, history, and social criticism include *Men of Mathematics, The Magic of Numbers,* and *Mathematics, Queen and Servant of Science.* Under the pen name of John Taine, he has also published many magazine stories and 13 science fiction novels. Dr. Bell is a former President and Councilor of the Mathematical Association of America, a former Vice President and Councilor of the American Mathematical Society, and a former Vice President of the physical sciences section of the AAAS.

Dr. Epstein, who joined the Institute staff in 1921, has made many important contributions to theoretical physics, particularly in the fields of quantum theory, the structure of atoms, thermodynamics, the theory of elasticity, and fluid mechanics. He has published numerous scientific papers on these subjects and is the author of *Textbook of Thermodynamics.* He was elected to the National Academy of Sciences in 1930.

Born in Warsaw, Poland, then part of Russia, he received his bachelor's degree in 1906 at the University of Moscow. After the university awarded him the master's degree in 1909 he served there briefly as Assistant Professor of Physics, but with the threat of revolution hanging over Russia, he took a leave of absence to study at the University of Munich and never returned. He received his doctorate at Munich in 1914 and, after a brief period of internment during World War I, was allowed to continue his research there. After the war he taught and conducted research at the Universities of Zurich, Switzerland, and Leiden, the Netherlands, and then went to Caltech in 1921. He was naturalized in 1927.

Dr. Epstein's interests range widely beyond theoretical physics into philosophy, psychanalysis, and art. He is a trustee of the Psychoanalytic Institute of Los Angeles and the founder and a board member of the Psychoanalytic Study Group of Los Angeles. He is also a charter member of the Congress for Cultural Freedom, an organization of intellectuals established in 1951 to fight Communism and Communist propaganda on an international scale.

Col. Robert J. Benford, (MC) USAF, has been appointed editor of the *U.S. Armed Forces Medical Journal.* Col. Benford, who has relieved **Col. Wayne G. Brandstadt, (MC) USA,** is the first officer of the Air Force Medical Service to serve as an editor of the *Journal.* A graduate of the University of Nebraska College of Medicine, he was formerly on the staff of the Omaha *World-Herald.* He is a member of the advisory boards of the *Journal of Aviation Medicine* and the *Military Surgeon,* and recently he was also appointed to the editorial committee on physiologic problems of the Institute of the Aeronautical Sciences.

Thomas Bradley, formerly a practicing surgeon in Washington, D.C., has accepted an appointment in the Division of Medical Sciences, National Research Council. Dr. Bradley replaces **Charles E. Richards** who resigned to become Assistant Professor of Medicine, Bowman Gray School of Medicine, Winston-Salem, N.C.

President Eisenhower has nominated **Melvin A. Casberg,** assistant to Secretary Charles E. Wilson in charge of medical affairs, for appointment to the new post in the Department of Defense of Assistant Secretary for health and medical affairs. His incumbency will be for no more than six months, however, for Dr. Casberg has informed Secretary Wilson that he intends to leave government service at the end of this year to return to California and resume private practice.

L. Royal Christensen, Assistant Professor of Microbiology at the College of Medicine of New York University-Bellevue Medical Center, will be Director of the new Henry W. and Albert A. Berg Institute for Experimental Physiology, Surgery and Pathology. A native of Everson, Washington, Dr. Christensen received his B.S. in 1936 from the University of Washington and his Ph.D. in 1941 from the St. Louis University. He has been with the faculty of NYU College of Medicine since 1941.

Dr. Christensen is recognized for his scientific investigation of the preparation, purification, and mechanism of action of specific enzymes to determine whether they could safely be utilized for therapeutic application. Results of Dr. Christensen's findings, together with research carried forward by a team of physicians under the direction of **William S. Tillett,** Professor and Chairman of the Department of Medicine of NYU College of Medicine, resulted in the development of a new therapeutic technique. It became

possible to employ certain specific bacterial enzymes to liquefy clots and to permit the removal, by aspiration, of abnormal fluid accumulations in the body which, when not liquefied and removed, had often proved fatal. Dr. Tillett and Dr. Christensen received the 1949 Lasker Award in recognition of this important contribution to therapeutic techniques.

The Berg Institute was made possible through gifts from the late Albert A. Berg, the well-known surgeon who contemplated "a workshop where physiology and pathology would contribute nutriment for the growth of surgery." Dr. Berg's will provided $500,000 for construction of the Institute named for him and his brother, Henry, who was an authority on infectious diseases and internal medicine. He also provided a fund of well over $1,000,000 for maintenance of the Institute.

Ethaline Cortelyou has returned to the Armour Research Foundation after an absence of three years spent as an associate chemist in the Industrial Hygiene and Safety Division of the Argonne National Laboratory. Mrs. Cortelyou is report editor for the Foundation's Chemistry and Chemical Engineering Department.

Charles U. Duckworth has been appointed special assistant to the Secretary of Agriculture to serve in the cooperative efforts with Mexico for the eradication of foot-and-mouth disease in that country. He is going to Mexico immediately to confer with the Minister of Agriculture and other Mexican officials and to assist in formulating a program designed to lead to an early eradication of the disease. In accepting the appointment, Dr. Duckworth is interrupting an assignment with the Mutual Security Agency in Europe. For the past year and a half he has been assisting various countries in Europe and the Near East to combat foot-and-mouth disease. Dr. Duckworth is a veterinarian and has played a major part in the control and eradication of animal diseases in his home state, California.

H. Herbert Fox, Senior Chemist with Hoffman-La-Roche, Inc., has been selected to receive the Scroll of the New Jersey Science Teachers Association as the resident of New Jersey who has contributed most to science during the year. The award is being given to Dr. Fox for his work in the chemotherapy of tuberculosis and his discovery of the antitubercular hydrazides.

Nathanial Howell Furman, Chairman of the Department of Chemistry at Princeton University, has been selected to receive the 1953 Palladium Medal of the Electrochemical Society. The award will be conferred for outstanding contributions to the field of analytical chemistry, and particularly for successful application of electrochemical principles to the development of new methods and techniques of chemical analysis. Dr. Furman is a former president of the American Chemical Society.

Allan Juster, formerly project engineer with the National Bureau of Standards, has been named a full research engineer in the propulsion and structural research department at the Armour Research Foundation of the Illinois Institute of Technology.

George W. Martin has succeeded graduate Dean **Walter F. Loehwing** as Head of the State University of Iowa Botany Department. The change will enable Dean Loehwing, who has been associated with the University since 1925, to give full-time attention to the University's growing graduate college. A specialist in problems of cellulose decay in textiles, Dr. Martin is recognized as an authority on such fungi as slime molds and mildew. Since 1951 he has been Editor-in-Chief of *Mycologia,* a journal on fungi research published by the Mycological Society of America. He was President of the Society in 1945. Except for a year's leave in 1945, Dr. Martin has taught at SUI since 1923.

Norman Rostoker, former research physicist at Carnegie Institute of Technology, Pittsburgh, has been appointed a full physicist at the Armour Research Foundation of the Illinois Institute of Technology.

Werner B. Schaefer, a researcher at Pasteur Institute, Paris, both before and after World War II, has joined the staff of National Jewish Hospital, Denver, Colo., to make a study of the special growth requirements of tuberculosis germs which are resistant to isoniazid. Dr. Schaefer came to the U.S. in 1948. He spent his first two years in this country at N.Y. University, and the last three have been spent at the Rockefeller Institute where he has conducted research for several U.S. Public Health Service projects.

William C. Steere, Department of Biological Sciences, Stanford University, has been elected Editor-in-Chief of the *American Journal of Botany,* effective September 1.

William L. Stern, Department of Botany, University of Illinois, has been appointed Instructor in Wood Anatomy in the School of Forestry, Yale University, effective September 1.

Carsten C. Steffens, Assistant Director of the Stanford Research Institute from 1947 to 1949, has returned to the Institute as Technical Coordinator of the research divisions. For the past four years Dr. Steffens has been Associate Professor of Chemistry at the University of New Mexico. In his new position he will follow progress of all research groups and act as technical advisor on certain industrial projects. A specialist in physics of the atmosphere, Dr. Steffens in 1947 helped initiate SRI's study of smog in Los Angeles. He developed a photometric photometer for measurement of haze particles in the atmosphere. He also helped develop physical methods for investigating atmospheric impurities.

Education

Cornell University recently dedicated two new laboratories for the study of engineering materials. The buildings, erected from a $1,800,000 fund subscribed largely by alumni, are memorials to two of Cornell's most prominent engineering figures, Dexter S. Kimball, first Dean of the College of Engineering, and Robert H. Thurston, original President of the American Society of Mechanical Engineers.

The **Florida State Museum,** a unit of the University of Florida in Gainesville, has made the following appointments to its curatorial staff: A. Gilbert Wright, Curator of Exhibits, formerly Curator of Zoology, Illinois State Museum; Ripley Bullen, Curator of Social Sciences, formerly Assistant State Archeologist, Florida Park Service; and J. C. Dickinson, Jr., Curator of Biological Sciences. Dr. Dickinson will continue as Assistant Professor in the Department of Biology as well as in his new position with the Museum. The Museum is also inviting experts on the University staff to join the Museum's Board of Associates in order to sponsor the Museum's collections in their particular specialties.

Publication of a magazine to present General Motors technical developments to educators and engineering college students has commenced with the release of the June–July issue. The new publication will be known as the *GM Engineering Journal* and it will appear bi-monthly during the school year and once during the mid-summer months.

A permanent **high-altitude research observatory** has been successfully established on the 14,006-foot summit of Mt. Wrangell, a dormant volcano, by an expedition led by **Serge A. Kroff,** Professor of Physics at New York University, and **Terris Moore,** President of the University of Alaska. The station will provide an inter-university center for research in cosmic radiation, high-altitude biology, and meteorology. A party of five persons climbed the mountain on foot, arriving at the summit on July 1. They were the second group ever to reach the summit, the first successful ascent having been made in 1908.

Two Jamesway huts and related supplies and equipment have been airdropped to the party by a private plane piloted by Dr. Moore. One of the huts is used as living quarters by the research workers; the other is a laboratory housing scientific supplies and equipment. It is believed that Dr. Moore, who took off from the summit with Dr. Korff as a passenger and with a load of cargo, has established a new record for loaded takeoffs of light private planes at high altitudes. He also, thus, has demonstrated the feasibility of supplying the station entirely by air.

In answer to increased demands for recreation specialists in institutional work, **New York University's School of Education** will offer a new graduate curriculum in hospital recreation, beginning with the fall term. The group of courses, to be conducted in the Department of Physical Education, Health, and Recreation, will train graduates to inaugurate and carry out recreation programs in custodial institutions, hospitals, homes for the aged, and rehabilitation centers.

Grants and Fellowships

The Jane Coffin Childs Memorial Fund for Medical Research has announced the following appropriations made by its Board of Managers on October 25, 1952, February 11, 1953, and May 15, 1953, in a total sum of $238,480 for support of cancer research projects and fellowships.

Projects

Harris Busch, Assistant Professor of Physiological Chemistry, Yale University School of Medicine, $7,950 for a year (1952–53) and a second grant of $18,000 for a two-year period (1953–55) for investigations on the metabolism of tumors *in vivo*.

Cancer Research, Incorporated, $9,000 for a three-year period (1/1/53–12/31/55) for continued support of the journal *Cancer Research*.

F. Duran-Reynals, Lecturer, Department of Microbiology, Yale University School of Medicine, $49,500 for a three-year period (1953–56) for the study of the part played by viruses in the genesis of cancer.

William U. Gardner, Professor of Anatomy, Yale University School of Medicine, $20,400 for a three-year period (1953–56) for investigations on hormonal imbalances in experimental tumorigenesis.

William H. Gaylord, Research Associate in Microbiology, Henry Bunting, Associate Professor of Pathology, and Sanford L. Palay, Assistant Professor of Anatomy, Yale University School of Medicine, $5,000 for one year (9/1/53–8/31/54) for investigations of the intracellular development of virus particles and its relation to neoplasia.

Gabriel C. Godman, Research Associate in Surgery, College of Physicians and Surgeons, Columbia University, $2,980 for one year (1953–54) for a cytochemical study of nucleic acid and protein synthesis in cultured cells during the mitotic cycle, with particular reference to the effect of certain antimetabolites.

Alexander Haddow, Director, and his associates at the Chester Beatty Research Institute of the Royal Cancer Hospital (Free). London, England, $5,000 for a year (1953–54) for investigations on the chemistry, virology, and chemotherapy of cancer.

Clarence C. Little, Director, Roscoe B. Jackson Memorial Laboratory, $6,500 for one year (1953–54) for the planned study designed to modify the virulence of the mammary tumor inciter in mice.

Balduin Lucké, Professor of Pathology, University of Pennsylvania Medical School, $23,100 for a three-year period (1/1/53–12/31/55) for investigations on enzyme patterns in relation to the development and growth of neoplasms and the mechanism of metastasis.

Basile J. Luyet, Professor of Biology, Saint Louis University, $3,500 for one year (1953–34) for investigations on the relationship between the degree of preservation of red cells in frozen blood and the amount of ice formed.

Leon L. Miller, Associate Professor of Radiation Biology and Biochemistry, University of Rochester School of Medicine and Dentistry, supplementary grant of $11,250 for a period of one and one-half years (1/1/53–6/30/54) for physiological and chemical studies of protein synthesis as related to neoplastic growth.

National Academy of Sciences, $3,000 for a three-year period (1953–56) for assistance in the compilation of an Atlas of Tumor Pathology, under the direction of Balduin Lucké, Chairman of the Subcommittee on Oncology of the Committee on Pathology of the National Research Council.

National Research Council, U.S.A. National Committee on the International Union Against Cancer, R. Keith Cannan, Vice-Chairman, $500 for a year (1952–53) toward the budget of $8,500 which the United States has been asked to assume of the total expenses of the Union.

Elmer H. Stotz, Professor of Biochemistry, University of Rochester School of Medicine and Dentistry, $20,000 for a two-year period (1953–55) for investigations on the oxidation capacity of hormone-stimulated uterus and of tumor.

Helene W. Toolan, Assistant, Sloan-Kettering Institute for Cancer Research, Memorial Center for Cancer and Allied Diseases, $15,000 for a year (1953-54) for investigations on the growth of human tumors in laboratory animals, and the relationship of hormones to the growth of certain special tumors, such as melanomas and mammary adenocarcinomas in these animals.

John J. Trentin, Assistant Professor of Anatomy, Yale University School of Medicine, $6,000 for a three-year period (1953–56) for investigations on the influence of the endocrines on the mammary gland, including development of lactation and tumorigenesis.

William W. Winternitz, Instructor, and C. N. H. Long, Professor, Department of Physiology, Yale University School of Medicine, $24,000 for a two-year period (1953–55) for investigations on the effect of transplantable tumors on the metabolism of the host (albino rats).

Fellowships

Paul A. Srere, Fellow, Department of Physiological Chemistry, Yale University School of Medicine, under guidance of Efraim Racker, $4,000 for one year (September 1, 1953–August 31, 1954).

Maire T. Hakala, Fellow, Department of Pharmacology, Yale University School of Medicine, under guidance of Arnold Welch, $3,800 for one year (October 1, 1953–September 30, 1954).

Leonard S. Silbert has been appointed senior fellow under a multiple fellowship recently established by the **National Renderer's Association** at the U.S. Bureau of Agricultural and Industrial Chemistry's Eastern Laboratory in Wyndmoor (Philadelphia) Pa. The multiple fellowship is part of a new research program being initiated by the Association to find new uses for inedible tallow and grease.

The **National Vitamin Foundation** gives grants-in-aid for research semi-annually, throughout the country and abroad. New grants, amounting to $69,710, became effective on June 30 and were awarded to the following:

Louis D. Greenberg and J. F. Rinehart, University of California, San Francisco, for studies on the fundamental biochemical and morphologic pathology of B-vitamin deficiencies in the Rhesus monkey.

Richard W. Vilter, University of Cincinnati, for studies in nutrition.

E. L. Hove, Alabama Polytechnic Institute, for studies on the influence of vitamin E and other nutrients on tissue fat composition.

David R. Weir, Western Reserve University, for studies on the role of B vitamins in leucocyte formation in normal and pathologic conditions of human beings and mice.

Robert E. Olson, University of Pittsburgh, for studies on the interrelationship of thiamine, pantothenic acid and insulin in the metabolism of carbohydrates.

William F. Alexander, St. Louis University, for studies on the relation of vitamin B_{12} to nerve cell metabolism and studies on the role of vitamin B_{12} in protecting nerve tissues against chemical poisons, fatigue, and prolonged stimulation.

Karl E. Mason, University of Rochester, for studies on vitamin E (alpha tocopherol) in tissues with particular reference to its intracellular localization.

E. W. McHenry, University of Toronto, for studies on the relation of vitamin B_6 to protein metabolism.

Albert E. Sobel, The Jewish Hospital of Brooklyn, for studies of the vitamin D estimation in blood.

Josef Warkany, University of Cincinnati, Cincinnati, Ohio, for studies on the role of vitamins and related substances in pregnancy and prenatal life.

Elaine P. Ralli, New York University, New York, N. Y., for studies of the influence of certain nutritional fractions in patients with diabetes mellitus.

R. W. Luecke, Michigan State College, for studies on the quantitative requirements of the baby pig for certain B vitamins.

Gerald R. Seaman, University of Texas, for studies on the metabolic role of thioctic acid.

M. K. Horwitt, Elgin State Hospital, Elgin, Ill., for studies of tocopherol requirements of man.

Meetings and Elections

The **Association of Research Directors** has elected the following officers for the 1953–54 season: past president, Emil Ott, Hercules Powder Company; president, Allan R. A. Beeber, Keuffel & Esser; vice president, Delbert F. Jurgensen, Congoleum-Nairn, Inc.; secretary treasurer, D. X. Klein, Heyden Chemical Corporation; councilors, 1 year, W. H. Lycan, Johnson & Johnson, 2 years, Maurice Moore, Vick Chemical Company, 3 years, Wayne Kuhn, The Texas Company.

The IX **International Congress of Genetics** will take place at Bellagio, Italy from the 24th to the 31st of August. More than 750 members are enrolled so far, including 126 North Americans. Thirty-eight countries are expected to attend the meeting, and a number of governments, academies, universities, and learned societies will send official representatives. Nearly 300 short papers are being contributed, and 43 general lectures will be given. The following seven Plenary Sessions are scheduled: Bases of Heredity; Genetic Mechanisms and Mutations; Cytologic Mechanisms; Development Mechanisms; Evolutionary Mechanisms; Human Genetics; Applied Genetics. Post-Congress tours are planned during which visits of scientific interest will be organized.

At the 17th Triennial Convention of **Phi Lambda Upsilon** four American chemists were elected to honorary membership. They are: Charles A. Thomas, President of Monsanto Chemical Company; Farrington Daniels, Professor of Physical Chemistry at the University of Wisconsin and at present the President of the American Chemical Society; Hermann I. Schlesinger, Professor of Inorganic Chemistry at the University of Chicago and Ernest H. Volwiler, President of Abbott Laboratories.

Another **Rochester conference on high energy nuclear physics** is assured early next year at the University of Rochester as the result of an announcement by the National Science Foundation that it will join a group of Rochester industries to co-sponsor the next meeting. The National Science Foundation will support the fourth annual Rochester conference with a grant of $3,000. The Foundation granted $3,200 to help meet expenses of the third annual conference held last December. Purpose of the Rochester high energy nuclear conferences is to bring together a representative group of active workers in the field of high energy physics for an informal discussion of the latest experimental results and their theoretical interpretation. Invitees include the leading research workers in the high energy physics laboratories throughout the world.

Technical Papers

A New Dense Crystalline Silica

L. Coes, Jr.

Research and Development Department, Norton Company, Worcester, Massachusetts

In the course of some experiments at high pressure, directed at determining the conditions of formation of several naturally occurring minerals, a new dense form of crystalline silica has been discovered. The new silica has not previously been described as the product of synthesis nor has it been discovered in nature as a rock constituent.

The conditions needed for the formation of the new dense silica, together with its great stability, may provide a means by which the conditions attendant on the crystallization of some deep-seated rocks can be more closely estimated. Its absence from these rocks provides a maximum pressure above which they could not have been formed.

A subsequent paper on the synthesis of several naturally occurring minerals will greatly amplify this information.

The information on rock-forming conditions is made more valuable by the variety of chemical environments from which the dense silica can crystallize and to the wide temperature range over which it can form above a critical pressure.

The possibility exists that the existence of this form of silica in nature may have been overlooked. In some cases it may have passed for a mica which it resembles in form, refractive index, and double refraction. It is easily distinguished from the micas, however, by its hardness and insolubility in hydrofluoric acid.

The experiments were carried out in an apparatus similar to that described by Bridgman (*1*). The apparatus was modified to provide for internal heating in a manner which will be completely described in a subsequent paper.

The reaction mixtures used in the experiments were sealed into small iron capsules, 3/16 in. O.D. and 1/2 in. long. Pressure calibration of the apparatus was made by observing the polymorphic transition of bismuth, in the capsule, at 27,000 atmospheres as given by Bridgman (*2*). In this way, the error in the pressure measurement was estimated to be about ±2000 atmospheres and was caused chiefly by mold friction.

Heat was supplied by an electrical resistance element surrounding the capsule. Temperature was measured by the thermocouple placed near the capsule and calibrated against a thermocouple placed in the position of the capsule. Observations on the melting point of high-purity (NBS) aluminum and silver indicated that temperature could be measured and controlled to within ±10° C in the range 600–900° C.

In carrying out the experiments the reactants were sealed in the capsules and put under pressure. The temperature was raised and held at the desired point for the duration of the experiment. At the end of the run the pressure was released, and the capsule was removed from the mold. The dense silica was isolated by dissolving the capsule in hydrochloric acid and treating the residue in turn with hot nitric acid, hot chromic acid, and hot hydrofluoric acid.

The best reaction mixture found for the dense silica formation consisted of equal parts of dry sodium metasilicate and diammonium phosphate. Two-tenths gram of this mixture was charged into the mold and sealed. The capsule was heated at a temperature of 750° C under a pressure of 35,000 atmospheres for a period of 15 hr. The yield varied from 20–30 mg of dense silica in colorless tabular hexagonal crystals up to 50 μ in diameter.

Mineralizing agents other than the diammonium phosphate were used with as nearly satisfactory results, the better ones being: boric acid, ammonium chloride, ammonium vanadate, and potassium fluoborate. Potassium silicate may be substituted for the sodium silicate with good results. Boric acid and powdered flint give about one-half the yield of the sodium silicate-diammonium phosphate system and somewhat poorer crystallization of the product. This process is interesting, however, in that it shows that the metal ions are not necessary for the dense silica formation. The use of tantalum capsules in place of iron does not change the results.

The dense silica can also be produced, in good yield, under the same pressure and temperature conditions by the oxidation of silicon by silver carbonate, the silver carbonate being reduced to metallic silver. This experiment shows that hydrogen is not a factor in the dense silica formation.

The various syntheses described above establish without question that the new substance is a compound of silica and oxygen. It is completely volatilized by heating with ammonium bifluoride. It is transformed, without change in weight, into silica glass and cristobalite when heated in platinum at 1700° C. These experiments establish that the new substance has the composition SiO_2 and is a new crystalline form of silica.

The stability region for the dense silica has been approximately determined by synthesis only. Its great stability, once formed, has made any measurements on the reverse transformation impossible. The data which have been accumulated on the synthesis do not seem to indicate a conventional type of rising pressure-temperature stability curve. To what extent this may be due to the sluggishness of the transformation is not known. In any case, it has been found that no dense silica formation takes place below 35,000 atmospheres pressure and that at 35,000 atmospheres dense silica is formed at any temperature between 500–800° C. Formation probably takes place below

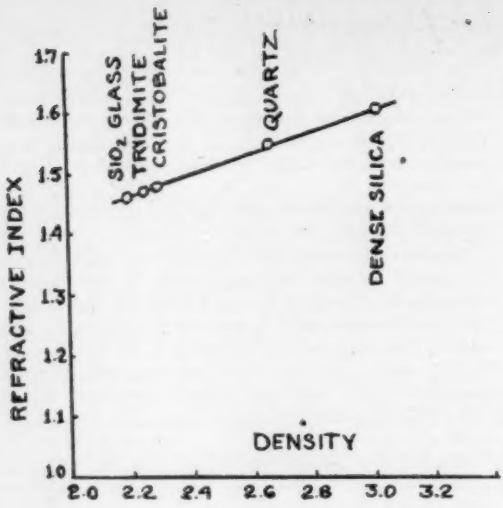

FIG. 1.

500° C but is too slow to be observed experimentally.

Below 35,000 atmospheres in the above temperature range, normal quartz is produced by the same chemical reactions. Occasionally, near 35,000 atmospheres, mixtures of dense and normal quartz have been produced though it is not clear whether the formation was simultaneous or was the result of pressure variation in the system. Above 800° C, at 35,000 atmospheres, only normal quartz is produced.

The dense silica crystallizes in hexagonal plates with unsymmetrical extinction. It is biaxial and optically positive with an optic axial angle of 54°.

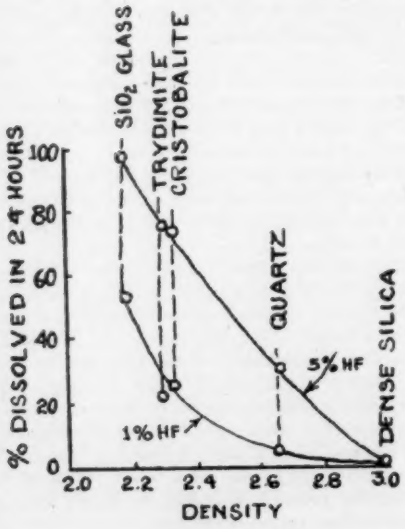

FIG. 2.

The refractive indices are: $\alpha = 1.599$, $\gamma = 1.604$, $\gamma - \alpha = 0.005$. The crystals probably belong to the triclinic system and the following x-ray data have been obtained.

K_x	I	K_x	I	K_x	I
6.20	W	2.03	W	1.501	VW
4.38	VW	1.84	VW	1.418	VW
3.43	M	1.79	W	1.409	VW
3.09	VS	1.71	W	1.345	W
2.76	W	1.70	W	1.321	VW
2.69	W	1.66	VW	1.285	W
2.33	W	1.58	VW	1.236	VW
2.29	W	1.545	W	1.171	VW
2.18	W				

The density is 3.01. The density–refractive index relation correlates well with other forms of silica as is shown in Fig. 1.

The hardness (Knoop, K_{100}) is 1200 and stands in the following relation to other substances of similar hardness (*3*)

α-Quartz	820[1]
Dense silica	1200
Linde spinel	1270[1]
Thomas Range topaz	1340[1]
Barton Mine garnet	1360[1]

Chemically the dense silica is very inert and shows less chemical reactivity than normal quartz. It is not attacked by long heating in hydrofluoric acid. In view of its density this fact correlates well with the data collected by Schwarz (*4*) on the rates of solution of other forms of silica in hydrofluoric acid of various concentrations. Figure 2 shows solution rates for the different forms plotted against the density.

The dense silica is rapidly dissolved by fused ammonium bifluoride.

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Tryptophan Synthesis in *Claviceps purpurea*[1]

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The reaction, indole + serine → tryptophan was demonstrated to occur in a mutant strain of *Neurospora crassa* (*1, 2*) and in a cell-free extract of *Neurospora sitophila* (*3*). A similar pathway has been reported to exist in *Salmonella typhosa, Escherichia coli* (*4*),

[1] This work was aided by a grant from the Eli Lilly Company, Indianapolis, Indiana.

and *Lactobacillus arabinosus* (*5*), but more recent work has cast doubt upon the occurrence of this reaction in the latter organism (*6*). It was postulated that tryptophan was formed by the condensation of indole and serine in spinach leaves, but no experimental evidence has been presented (*7*).

Studies in this laboratory, devoted to the biogenetic relationship between tryptophan and lysergic acid, revealed that the mycelium of *Claviceps purpurea* (Fries) Tulasne possessed considerable tryptophan desmolase activity. The strain of *Claviceps* used was isolated from a sclerotium of barley ergot and subjected to a process of physiological adaptation until it was capable of prolific mycelial development in submerged culture. The medium used consisted of a basic mineral nutrient solution (*8*) containing 2% mannitol and 0.1% each of *dl*-alanine, *l*(−)-asparagine, *l*(+)-aspartic acid, *l*(+)-glutamic acid, *l*(−)-leucine, and *dl*-valine.

Mature mycelium (7–10 days growth) was collected, washed with distilled water, and portions (ca. 50 mg dry weight) were transferred to test tubes containing approximately 100 γ of indole and 2 mg of *dl*-serine in 2 ml of water. *M*/15 phosphate buffer was then added to produce a total volume of 5 ml in each tube. The tubes were agitated on a reciprocal shaking machine at room temperature for periods up to 8 hr. Ten milliliters of toluene was pipetted into each tube and shaken vigorously in order to stop the reaction by removal of unutilized indole. The tubes were then centrifuged, filtered, aliquots of the toluene layer assayed for indole by the process of Wood *et al.* (*9*), and aliquots of the aqueous layer for tryptophan by the method of Nason *et al.* (*10*). Control tubes containing washed *Claviceps* mycelium and water failed to show any accumulation of indole or tryptophan. The results of a series of analyses are reported in Table 1. Tryptophan formation correlated with indole disappearance, and yields of nearly 90% of theory were obtained. The product was further characterized by spotting quantities of the aqueous layer of tubes showing considerable tryptophan accumulation on strips of Whatman No. 1 filter paper and chromatographing with butanol-acetic acid-water (*11*) and methanol-butanol-benzene-water (*12*). From the qualitative data obtained it was concluded that *Claviceps* has ability to utilize indole and serine to produce tryptophan under the conditions described.

TABLE 1

INDOLE UTILIZATION AND TRYPTOPHAN FORMATION
(Indole added = 96 γ/tube)

Reaction time (hr)	1	2	4	8
	Indole utilized (γ)			
Tube 1	19	39	91	96
2	14	35	91	96
3	15	38	90	96
Av	16	37	91	96
	Tryptophan formed (γ)			
Tube 1	24	51	81	154
2	18	51	90	146
3	20	48	95	138
Av	21	50	89	146

The study of *Claviceps* metabolism is being continued, with special emphasis upon other possible tryptophan precursors, as well as upon products formed by tryptophan utilization.

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Oxygen Consumption of Adrenal Slices from Normal and Scorbutic Guinea Pigs and the Influence of Added ACTH[1,2]

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Oxygen consumption by slices of adrenal cortex has been used as a criterion of cortical cellular metabolism by several groups of workers (*1–3*). Carpenter *et al.* (*1*) observed an increase in oxygen utilization and of aerobic lactic acid production by the adrenal cortices of rats treated with large doses of ACTH. Tepperman (*2*) found when purified ACTH was added *in vitro* to slices of dog adrenal cortex that the oxygen consumption of the tissue was increased and its ascorbic acid content depressed. Hecter *et al.* (*4*), working with whole perfused cow and hog adrenal glands and Haynes and co-workers (*5*), utilizing slices of adrenals have demonstrated an accelerated synthesis of 17-hydroxycorticosterone and of formaldehydogenic substances by the *in vitro* addition of purified ACTH.

[1] This work was carried out under U.S. Atomic Energy Contract AT(30-1)-901 with the New England Deaconess Hospital.

[2] The authors wish to thank Ellen L. Marston for technical assistance in this study.

[3] Supported in part by the Higgins Fund. Present address, Dept. of Physiological Chemistry, University of California Medical Center, Los Angeles.

In this study an isotonic inorganic medium and respiratory system was developed whereby maximum and constant oxygen consumption values were obtained. This system was then utilized for determining (a) the respiratory activity of various portions of the guinea pig adrenal gland, (b) the total oxygen utilization of the glands from normal and scorbutic animals, and (c) the changes in oxygen consumption with *in vitro* addition of ACTH.

The isotonic suspending medium employed was the same as that used for investigations on Ehrlich's ascites carcinoma cells (*6*) and was modified from that employed in the studies on malaria parasites (*7*). The composition of the medium, in grams per liter, is: $NaH_2PO_4 \cdot H_2O$ 1.5185, Na_2HPO_4 6.2480, NaCl 3.9370, KCl 0.4100, $MgCl_2 \cdot 6H_2O$ 0.0950, $CaCl_2$ 0.0560, $MnCl_2$ 0.0020. Variations in the inorganic composition of the medium were investigated and it was determined that halving or doubling the concentration of Ca^{++}, Mg^{++}, and Mn^{++} did not alter the oxygen consumption of the adrenal slices. Likewise, small increments of the K^+ content of the medium had little or no effect; however, increasing the concentration, from 5.5 mM/l to 110 mM, and compensating for the change by decreasing the Na^+, diminished the oxygen utilization by 15–25%.

The most important technical aspects of this problem are the rapidity and care with which the adrenal slices are prepared. Chilling and keeping the glands cold is not necessary providing one works rapidly, and rigorously avoids drying and fragmenting the tissues. Thus upon sacrificing the animal the adrenals were immediately removed, dissected free of fat and connective tissue, and placed in a Petri dish containing a piece of filter paper moistened with the isotonic suspending medium.

Slicing of the gland was carried out rapidly, using a 0.5-mm Stadie-Riggs hand microtome slicer containing a disk of ashless filter paper moistened with the isotonic medium. The glands were cut into 4 slices, each about 0.5 mm thick, the outer 2 being principally cortical tissue while the inner 2 slices were mixtures of cortical and medullary tissue. As each slice was removed from the slicer it was placed on parafilm paper, quickly weighed on a Roller-Smith torsion balance, and immediately placed in a small size (7 ml) Warburg vessel containing 0.75 ml of suspending medium and 0.1 ml of 6% glucose solution, and with 0.1 ml of 15% potassium hydroxide and an accordion (15 × 20 mm) of Whatman 40 filter paper in the center well. The vessels were placed on the manometer in the 38° C bath, flushed with 100% oxygen and equilibrated for 10 min. Oxygen consumption was measured for a period of 3 hr and the values reported here are for the second hour which, in most cases, was the most linear portion of the curve. From 20 to 40 mg of tissue were employed for each vessel. The left adrenal was used for respiration studies and the right gland for dry weight determinations. The oxygen consumption values for the whole glands were obtained by summing the values for the 4 individual slices.

Glucose, glycerol, and sodium lactate were tested as substrates for respiration. Glucose was found to be superior and routinely used. Without any added substrate the oxygen utilized was about 20% less than when glucose was added.

Cyanide (*8*), inhibited oxygen consumption 15, 68, and 87% at concentrations of 10^{-4}, 10^{-3}, and 10^{-2} *M*, respectively. Ascorbic acid added to the system did not change the oxygen uptake.

Employing the above described system and observing the indicated precautions, it was possible to obtain maximum and reproducible values for oxygen consumption. The animals were made scorbutic as described in a previous publication (*9*) and were used after 21–28 days on the scorbutic diet. It is of considerable interest that the Q_{O_2} values for the scorbutic guinea pig adrenal glands are nearly twice those for normal glands (Table 1). Although not given in the table, values for the individual tissue slices showed the oxygen consumption for the slices of cortex to be more than twice that for the center gland slices composed of mixed medullary and cortical tissue (137 and 57 mm^3/100 g wet weight, respectively).

Table 1 indicates the *in vitro* effect of adding 2 mg of ACTH per Warburg vessel. There is with the normal adrenal tissue a 55% increase in oxygen consump-

TABLE 1

In vitro EFFECT OF ACTH* ON OXYGEN CONSUMPTION OF NORMAL AND SCORBUTIC GUINEA PIG ADRENAL SLICES

Whole adrenal slices	Oxygen uptake		Dry weight of glands
	(mm^3/hr/100 mg wet weight)	(Q_{O_2})	(%)
Normal	86 (7)†	2.77	31 (5)
Normal + ACTH	125 (2)	4.03	—
Scorbutic	141 (7)	5.63	25 (5)
Scorbutic + ACTH	149 (2)	5.96	—

* Two milligrams of Armour's ACTH, No. 212-74, 45% of activity of La-1-A, were added per vessel. We are indebted to Edwin E. Hays of the Armour Research laboratories for this material.

† The total numbers of animals used in these studies are given in parentheses. The values are average figures for the adrenals (animals), each being obtained from 4 slices. Variations among glands were no more than ± 10%.

tion; whereas with the scorbutic tissue, there is no increment of oxygen utilization. The reason for the lack of augmentation of respiration in the scorbutic gland is not apparent; however, it is possible that the tissue is already stimulated maximally. Long (*10*) has obtained evidence of increased cortical hormone activity following the injection of ACTH into guinea pigs kept for 14 to 16 days on a scorbutic diet. However, the report by Nadel and Schneider (*11*) which showed an increased excretion of formaldehydogenic substances by the scorbutic guinea pig in an advanced state of vitamin deficiency is indicative of the possi-

bility that the adrenals are near to a state of maximum stimulation.

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A New Technique for the Study of the Effects of X-Radiation on Mammalian Skin Maintained at Different Temperatures During Exposure[1, 2]

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Evidence relevant to the problem of the radiosensitivity of protoplasmic systems in relation to the temperature prevailing therein during exposure to ionizing radiations has been recently and fittingly characterized as "equivocal" (*1*). In addition to its theoretical importance, the issue, as it relates specifically to mammalian skin, is not without practical implications (*2*). Mammalian skin, subjected to reduced temperatures during exposure to x-radiation, exhibits increased radioresistance (*2, 3*); conflicting observations have been reported (*4*). The intricacies attending the general problem have been well outlined by Henshaw and Francis (*5*).

Heretofore, investigations on mammalian skin in this connection have employed techniques to which have been attached important disadvantages (*3, 6*); they may be summarized as follows: (*a*) for want of adequate shielding the radiation passes through the animal and affects considerably more than the skin, with the accompanying probability of significant indirect effects of the radiation on the skin; (*b*) the change in temperature induced by cold applications and ligation, while directed primarily to the skin, involves, in fact, a reduction in over-all metabolic level of large parts of the animal not directly under study; (*c*) such methods are chiefly effective only when applied to newborn mammals, which lack adequately developed temperature-regulating mechanisms (*2*); (*d*) the study of radiosensitivity of cold and warm areas of skin has, by and large, involved a study of responses in respectively different individual animals (i.e., response of cold skin in one animal and of warm skin in another) and, no less importantly, a spreading of controls among different animals; such a procedure does not reckon well with the real and vexing problem of individual variations in response to given conditions of irradiation.

It seemed of value to develop a technique calculated to circumvent the disadvantages and limitations outlined above and thereby pave the way for better controlled and less limited experiments. The basic features of such a technique are herein described. The method has been effectively proved in our laboratory; it is practicable for almost any type of homeotherm or larger poikilotherm. We believe that it will be interesting to those engaged in similar studies.

The technique is as follows (mice and rats employed principally): The animal is anesthetized with sodium Nembutal. Subsequently, two parallel, anteroposterior, skin-deep incisions are made, equidistant from the midline, on the back of the animal (about 6 cm in length and 5 cm apart in the rat). The skin flap between the incisions is separated from the underlying skeletal muscles. Beneath this loose flap of integument a hollow lead chamber is inserted (Figs. 1 and 3); by means of this element the cooling or warming of a definite area of skin is accomplished. The chamber is elevated so that its lower surface does not contact the underlying tissues; this involves only

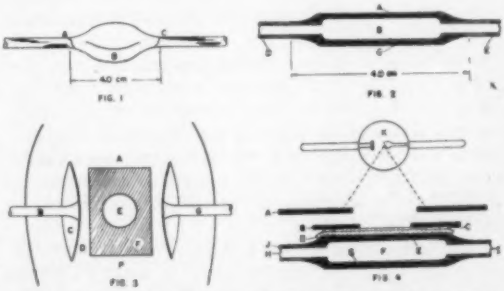

Fig. 1. Dorsolateral view of temperature-regulating chamber. *B*, chamber proper; *A*, *C*, junction of brass tubing inlet and outlet.

Fig. 2. View in longitudinal section of Fig. 1. *A*, *C*, upper and lower walls of lead chamber; *B*, interior of chamber; *D*, *E*, points of attachment of rubber tubing.

Fig. 3. Dorsal view of chamber in place. *A*, *P*, anterior and posterior on the animal; *B*, *G*, inlet and outlet; *C*, incision; *D*, region of lower left quadrant of separated flap of back skin; *F*, lead plate with aperture allowing exposure of skin area, *E*.

Fig. 4. View, in longitudinal section, of final arrangement. *K*, x-ray tube; *A*, lead plating protecting the animal proper; *B*, corresponds to *F* in Fig. 3; *C*, thin strip of plasitc used, optionally, to enhance contact of skin with tepmerature-regulating element; *D*, skin; *E*, *F*, *G*, upper wall, interior, and lower wall, respectively, of chamber; *J*, *H*, *I*, wall of brass tubing, inlet and outlet.

[1] This investigation was supported by the James Picker Foundation on recommendation of the Committee on Radiology, National Research Council.

[2] The invaluable technical assistance of H. J. Belli of Nash-Kelvinator Corp., R. Wilson of General Electric X-Ray Corp., and Dr. A. G. Barkow and F. Karioris of the Department of Physics, Marquette University, is gratefully acknowledged.

a slight stretching of the skin. The upper and lower walls of the chamber provide a thickness of lead sufficient to preclude penetration of x-rays below the chamber; thus the radiation is confined exclusively to the skin (Figs. 2 and 4). To the chamber are attached brass tubes, serving as inlet and outlet, for the circulation of water; the temperature of the water determines the temperature of the chamber. The circulation is effected by a simple siphoning arrangement.

The chamber, with brass tubing attachments, is supported by clamps, and the animal is slipped into position; rubber tubing is then attached to the inlet and outlet, and the circulation of water is begun. A piece of lead plating with a small circular aperture is then placed immediately upon the skin area overlying the chamber (Fig. 3). The skin is thus brought into fixed apposition with the surface of the temperature-regulating device; the aperture leaves a definitely circumscribed area of the skin to be exposed to the radiation. The skin is conditioned to the temperature prevailing in the system for a period of 10–15 min before irradiation. We have ascertained that the temperature of the skin very closely approximates the temperature of the lead surface upon which it rests. The cooling of skin is enhanced by the ligating effect of the lead plate upon the cutaneous blood vessels. The entire animal, with the exception of the small circular area of skin to be irradiated (Fig. 3, *E*), is shielded by a large lead plate.

In our early experiments the irradiation of warm and cold areas of skin was effected in respectively different animals; similarly the controls. However, we have adapted the technique of a tandem arrangement of two pairs of chambers to make it possible to produce, simultaneously, on one and the same experimental animal, in symmetrical pattern, two cold skin areas (approx. 5° C) and two warm skin areas (approx. 40° C); one of each pair serves as an experimental area and the other as the control. At temperatures we have employed, we have never encountered any untoward responses of control areas. After irradiation the incisions are closed with nickel silver wound clips.

The advantages of this technique may be summarized as follows: (*a*) the radiation is strictly confined to a definitely localized region of the skin; (*b*) the regulation of temperature is similarly localized; (*c*) the warming and cooling of skin areas can be simultaneously effected in one and the same experimental animal, with, in addition, the appropriate controls on the same animal; (*d*) the use of the basic features of the method are desirable even when there is no concern with the experimental regulation of the temperature of the skin; (*e*) one need not, with this technique, be confined to the use of newborn mammals; (*f*) the technique can profitably be employed in the study of elements other than mammalian integument and, it would seem, could be adapted to subserve profitably the analysis of a variety of radiobiological problems.

Details regarding the use of this technique, and evidence deriving from our studies on the radiosensitivity of mammalian skin in relation to temperature, will be published elsewhere.

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Centrifugal Preparation of Rat Liver Mitochondria Free of Microsomes[1]

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The isolation in bulk quantities of cytoplasmic particulates from rat liver cells by the differential centrifugation technique, originally described by Claude and further developed by Hogeboom *et al.* (*1*), is being widely applied in the study of cell physiology. In the preparation of the mitochondrial fraction, several investigators have called attention to the occurrence of a loosely packed material which sediments over the more compact mitochondrial pellet at one stage of the fractionation. Thus Muntwyler *et al.* (*2*) emphasized the need for removal of this material from the mitochondria. They reached the conclusion that it was more properly a part of the microsomal fraction, largely on its microscopic appearance and on the relative nitrogen and pentose nucleic acid content of the mitochondrial and microsomal fractions with various partitionings of the intermediate material. Schneider and Hogeboom (*3*) reaffirmed their original mention of the errors introduced by not removing this material from the mitochondria, i.e., too much nitrogen and pentose nucleic acid in the latter and too little in the microsomes. Most recently, Potter *et al.* (*4*) stated the likelihood that the loose material is probably microsomal rather than mitochrondrial in nature, based on its staining properties.

The present study was made to devise a procedure for a more complete separation of the intermediate fraction from the mitochondria. Also, additional evidence has been obtained that this fraction is part of the presently accepted microsomal fraction, and should be incorporated with it.

When centrifugation of the mitochondrial fraction is carried out at 15,000 × gravity by the usual method (*1*) in a large, e.g., 2.5-cm diameter tube it is difficult to see the boundary between the loose upper layer and

[1] Work performed as part of Contract N7onr-29504 between the Office of Naval Research and University of California.

the mitochondrial layer, and a sharp separation is not possible. In order to overcome this difficulty, only the clear supernatant liquid, containing a large proportion of the microsomes, is removed and the entire sediment is transferred to a smaller, 9-mm diameter lucite tube. The mixed material is resuspended in about 3 volumes of either 0.25 *M* or 0.88 *M* sucrose solution with the aid of a pestle made from a small piece of glass tubing with a bubble blown on the end to fit the lucite tube. Upon recentrifugation at 15,000 × gravity for 15 min (30 min if 0.88 *M* sucrose is being used), a pinkish white material is loosely layered over the sharp mitochondrial boundary. This material is easily removed by means of a fine capillary pipet, care being taken to remove no mitochondria. The mitochondria are resuspended and the process is repeated until no more loose material appears over the mitochondria. The washings, including the loose material, are added to the clear supernatant liquid removed in the first step described above, and the whole is centrifuged at high acceleration, e.g., 100,000 × gravity, to separate the microsomal fraction, if desired.

It was found that at least 3 or 4 washes are usually required to remove the intermediate material completely from the mitochondrial fraction. In the first unwashed mitochondrial sediment this material occupies about 60–70% of the whole pellet volume, and after 1 wash it still represents 40–50%. These proportions were determined by centrifugation in capillary tubes approximately 3 mm in diameter to give an elongated pellet.

The intermediate material could be conveniently collected separately by this method, and its properties were compared with those of purified mitochondrial and microsomal fractions in the following experiments.

(a) A suspension of the intermediate material was centrifuged at high acceleration into a compact pellet. The pellet had the characteristic appearance of a microsome pellet, a pink gel, with a trace of buff mitochondria at the bottom.

(b) Electronmicrograms of the intermediate material, while revealing aggregation of the constituent particles, showed that the particles were identical in size and shape with the microsomes.

(c) An optical ultracentrifuge sedimentation pattern of a suspension of the intermediate material centrifuged at 260,000 × gravity was compared with one of a microsome suspension. The patterns appeared identical, whereas purified mitochondrial suspensions give no pattern at all with these optics.

(d) Staining of the mitochondria, intermediate material, and microsomes separately by the method of Potter *et al.* (*4*) confirmed their findings. The mitochondria exhibited staining properties clearly different from those of the intermediate material and microsomes, while the latter were the same.

(e) The total nitrogen content of duplicate aliquots of the purified mitochondria from a rat liver was found to be higher than that of the intermediate material or the microsomes from the same liver, which were very similar, as may be seen in Table 1.

TABLE 1

TOTAL NITROGEN CONTENT OF VARIOUS LIVER CELL FRACTIONS

Fraction	Nitrogen content (g N/g dry sample*)	
	Sample 1	Sample 2
Mitochondria	0.124	0.124
Intermediate material	0.104	0.102
Microsomes	0.097	0.095

* Each fraction was washed once with distilled water to remove the bulk of the sucrose.

(f) Two rats were injected with a tracer dose of radiophosphorus-labeled phosphate and sacrificed after 7 hr. The nitrogen and phosphorus content, total phosphorus specific activity, and phospholipid phosphorus specific activity of the purified mitochondria, intermediate material, and microsomes were determined. As may be seen in Table 2, the mitochondria stand in sharp contrast to the intermediate material and the microsomes in every respect, whereas the latter two fractions are almost identical in their properties.

TABLE 2

N/P RATIO AND P SPECIFIC ACTIVITIES OF VARIOUS LIVER CELL FRACTIONS

Fraction	g N/g P of fraction		Specific activity of total P		Specific activity of phospholipid P	
	Rat A	Rat B	Rat A	Rat B	Rat A	Rat B
Mitochondria	13.5	12.9	0.41	0.51	0.38	0.50
Intermediate material	5.3	5.8	0.33	0.39	0.46	0.54
Microsomes	5.9	5.3	0.34	0.39	0.47	0.55

On the basis of these experiments, which included the examination of physical, chemical, and metabolic properties of the intermediate material, it is concluded that the loose upper layer sedimenting with the mitochondria is definitely microsomal in character and should be removed completely from mitochondrial preparations from rat liver cells. A procedure is outlined for effecting this end, and consists largely of several recentrifugations of the mitochondrial fraction.

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A New Series of Highly Active Local Anesthetics

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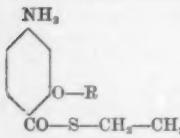
Previous reports from this laboratory (*1–3*) have described highly potent local anesthetics obtained by 2-ethoxy or higher 2-alkoxy substitution of the molecule of procaine. Local anesthetic activity, toxicity, and irritancy increased with the length of the alkoxy side chain, but the 2-ethoxy, the 2-*n*-propoxy and the 2-*n*-butoxy analogs were relatively much less irritating than procaine. It has now been found that, by sulfur substitution of the non-carbonyl oxygen in these and related alkoxy derivatives, an additional pronounced increase in activity can be obtained.

The thiolbenzoates used in the present work were prepared (*4*) from 2-alkoxy-4-nitrobenzoic acids and 2-diethylaminoethane thiol by methods analogous to those previously outlined (*5*). Local anesthetic activity was determined by the following methods: intracutaneous wheal in guinea pigs (Bülbring and Wajda's method [*6*]); intraspinal injection in rabbits (method of Bieter *et al.* [*7*]); corneal instillation in rabbits and urethral injection in rabbits (*8*). In all the methods linear dose-response curves were obtained by plotting the average scores or the average duration of anesthesia against the logarithm of the concentration or the concentrations drawn on a logarithmic scale. The activity ratios were determined by the ratios of the threshold anesthetic concentrations, which were estimated from the dose-response curves.



	R	Salt
WIN 3766	*n*-propl	H_3PO_4
WIN 3800	*n*-butyl	HCl
WIN 4510	*n*-hexyl	HCl

The local anesthetic activity and toxicity of these compounds in comparison with procaine, cocaine, tetracaine, and dibucaine are shown in Table 1. All the values are expressed or have been calculated in terms of the bases. Procaine has been taken as unity for activity determined by the intracutaneous wheal method and by intraspinal injection. Topical anesthetic activity was expressed by cocaine ratios, and toxicity was estimated in relation to both procaine and cocaine.

As shown in Table 1, WIN 4510 was the most active and most toxic of the compounds tested. After intraspinal injection in rabbits, a solution of 0.44% procaine (all values in the text are also expressed in terms of the bases) produced anesthesia in 3 of 4 trials for an average of 3.4 min, and a solution of 0.0014% of WIN 4510 produced anesthesia in all 5 rabbits for an average of 8 min.

Even more outstanding was the effect of these new compounds on the cornea and urethra. One of the smallest effective concentrations of WIN 4510, 0.00034%, produced corneal anesthesia in 7 of 8 rabbits for an average of 34 min. The total dose dissolved in approximately 0.5 ml of saline solution placed in contact with the cornea for 1 min was about 1.7 μg (*9*).

The anesthetic effect on the urethra was determined by injecting 0.5 ml of the solution into the urethra of lightly morphinized rabbits. The presence or absence of the urethral reflex (*10*) provoked by electrical stimulation (*8*) was used as a criterion of anesthesia. Each of 4 concentrations of WIN 4510 was tested on 8 or more rabbits. The lowest effective concentration was 0.00045%. Cocaine at 0.45% concentration produced anesthesia for an average duration of 5 min.

The irritancy of these compounds, as measured by the trypan blue test, increased with the length of the alkoxy side chain. It was low in comparison with the anesthetic activity. WIN 3766 had the highest activity/irritancy ratio of a large series of benzoate and thiolbenzoate derivatives tested in this laboratory (*11*).

Other related thiolbenzoates also possess high topical anesthetic activity. Several compounds in this

TABLE 1

ACTIVITY AND TOXICITY OF VARIOUS LOCAL ANESTHETICS

Compound	Local anesthetic activity				Toxicity		
	Procaine ratios		Topical cocaine ratios		Intravenous injection in mice		
	Intracutaneous wheal (guinea pigs)	Intraspinal injection (rabbits)	Corneal (rabbits)	Urethral (rabbits)	$LD_{50} \pm$ S.E. mg/kg	Procaine ratio	Cocaine ratio
Procaine	1	1			52.0 ±1.7	1	
Cocaine			1	1	19.0 ±1.0		1
Tetracaine			8.5		7.3 ±0.3		2.7
Dibucaine			11.0		4.7 ±0.3		4.0
WIN 3766	75	110	53.0	75	0.53 ± 0.02	98	36.0
WIN 3800	75	230	110.0	74	0.53 ± 0.02	98	36.0
WIN 4510	117	330	1000.0	1000	0.32 ± 0.02	160	60.0

series, especially WIN 3800 and WIN 4510, not only possess anesthetic activity considerably greater than that of tetracaine and dibucaine, but the topical anesthetic activity in experimental animals also indicates a greater margin of safety with regard to both irritancy and systemic toxicity.

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Parathyroid and Bone Citrogenase

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It is well known that when the parathyroid glands are removed the serum calcium falls, and, according to Albright and Reifenstein (*1*), the bones tend to become more dense in man, whereas after injection of parathyroid hormone the serum calcium rises and, in rabbits, a reduction of trabeculae of the epiphyses can be shown (*2*). Furthermore, in the experiments of Barnicot (*3*) and Chang (*4*) parathyroid tissue placed in contact with bone *in vivo* caused bone resorption, thus demonstrating a direct effect of the gland upon bone tissue. Therefore, in view of the influence of citrate on the solubility of calcium phosphate precipitated from solutions of physiological ranges of concentrations (*5*) and the presence in bone of enzymes governing the formation and further conversion of citrate (*6*), it seemed of interest to study the citrate content and citrogenase activity of bone in parathyroidectomized and normal rats, and in normal rats injected with parathyroid extract.

All animals were male albino rats and were fed on a stock diet of pellets containing 0.48% P and 0.63% Ca. Parathyroidectomized rats were killed 4–6 weeks after operation. In most cases the serum calcium level was determined immediately before sacrifice, the values obtained on the above Ca and P intakes (between 5 and 6 mg Ca/100 ml) indicating reasonable completeness of extirpation of the glands. Parathyroid hormone[2] was injected intraperitoneally 20 hr before sacrifice. In order to avoid any toxic effects, it was first dialyzed against distilled water until no further phenol reaction was obtained.

The proximal end of the tibia combined with the head and distal end of the femur (in each case comprising the epiphyseal and metaphyseal regions) was examined for citrogenase activity, and in some cases for citrate content, by methods previously described (*6*). The results obtained are given in Table 1.

TABLE 1

Bone Citric Acid and Citrogenase, and Serum Calcium in Parathyroidectomized, Normal, and Injected Rats*

Condition	Age in weeks	Bone citrogenase (mg citric acid formed/g tissue/hr)	Bone citric acid (mg/g tissue)	Serum calcium (mg/100 ml)
Normal	7	0.45 (2)		9.7 (2)
	10	0.24 (6)		9.5 (6)
	11	0.19 (7)	4.6 (4)	9.5 (5)
	24	0.09 (2)		—
4–6 weeks after parathyroidectomy	13	0.02 (5)	4.2 (4)	5.5 (3)
	14	0.0 (2)		5.3 (2)
	15	0.02 (3)		5.5 (2)
	18	0.01 (1)		—
4 days after parathyroidectomy	12	0.22 (3)		6.1 (3)
Normal, injected with parathyroid extract (150 u)	10	0.20 (3)		10.2 (3)
4 days after parathyroidectomy, injected with parathyroid extract (300 u)	12	0.21 (2)		12.5 (2)

* Figures in perens indicate the number of animals in the groups.

It can be seen that several weeks after parathyroidectomy the bone citrogenase activity had fallen to a very low level, far lower than that of normal animals of similar age range, whereas in the few determinations made the citrate content of the bones did not differ in the two groups. On the other hand, injection of a massive dose of parathyroid hormone into 10-week-old normals did not lead to any increase of bone citrogenase activity above the normal level for that age. In a few experiments which were performed on animals 4 days after parathyroidectomy, no lowering of the citrogenase activity was observed although the serum calcium had already reached a low level. Administration of parathyroid extract to such animals led to a considerable rise in serum calcium but no change in bone citrogenase activity. The serum cal-

[1] The authors wish to thank A. H. Gordon for helpful suggestions and Miss B. M. A. Davies for her ready cooperation in carrying out the parathyroidectomies.

[2] Eli Lilly, B.P.C. 1934 units.

cium level of operated animals was much more sensitive than that of normal animals to injected parathyroid hormone.

The figures for normal animals show that, as might be expected, increasing age led to lowered bone citrogenase activity. Because the fall in bone citrogenase after parathyroidectomy appears to develop slowly it is probable that the fall in serum calcium produced immediately after parathyroidectomy is not due to change in bone citrogenase. Also, the failure to increase the bone citrogenase by parathyroid hormone injection may have been due to the insufficient time allowed for this effect to develop.

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The Effect of Malonate on *Salmonella typhimurium* Infection in Mice[1]

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The effect of changes in the tricarboxylic acid cycle on *Salmonella typhimurium* infections in mice has been investigated[2] in order to determine the extent to which host metabolism influences response to this pathogen. In a series of experiments over a period of nearly 3 years (*1*), it has been established that mice exposed to the hypoxia of altitude are more susceptible to Salmonellosis than normal control mice. This greater susceptibility, however, is not accompanied by any experimentally demonstrable change in the mechanisms of defense against infectious diseases. A tentative explanation for these observations suggests that the stress of altitude results in some alteration in metabolism which in turn makes the mouse succumb more quickly to the infection. In the absence of any experimental evidence with which to substantiate the hypothesis, the present work was undertaken.

The particular procedure adopted was based on essentially unrelated reports in the literature. Mice subjected to the hypoxia of a simulated high altitude synthesize less influenza A virus in the lungs than control mice at normal pressures (*2*). Similarly, mice injected with sublethal amounts of sodium fluoroacetate synthesize less influenza A virus in the lungs (*3*) and less poliomyelitis virus in the central nervous system (*4*) than normal control mice. This poison, which probably blocks aconitase or isocitric dehydrogenase (*5*), results, *in vivo*, in an accumulation of citric acid in lungs (*3*) and in other organs (*6*). Another metabolic inhibitor, sodium malonate, which blocks succinic dehydrogenase (*7*) and possibly other enzymes (*8*), also produces an accumulation *in vivo* of citric acid in sublethal amounts (*9*). Since sodium malonate is known to be metabolized (*10*) and excreted (*9*) within a comparatively short time, repeated injections are required in order to maintain the block of the citric acid cycle (*9*).

Female mice of the CF-1 strain, weighing 20–25 g, were infected intraperitoneally with 0.5 ml of a saline suspension of *S. typhimurium* containing approximately 250,000 cells. Normal control mice receiving this number of bacteria suffer the first casualty on the third day, except in rare cases, and most of the animals succumb after 6 days. Twenty of these mice were given intraperitoneal injections of 0.5 ml saline at hourly intervals, starting immediately after the bacteria were administered and continuing for a total of 8 injections. The survival data of these animals are shown in Table 1, column 3. Twenty infected mice were treated in similar manner except that they were injected with 20 mg sodium malonate dissolved in 0.5 ml of saline for a total of 8 injections with the results shown in Table 1, column 2. The survival data of 15 mice not infected but given the 8 injections of malonate are given in Table 1, column 4.

It is apparent that mice infected with *S. typhimurium* die much sooner than control mice when their tricarboxylic acid cycle is blocked by sublethal injections of malonate. The malonate alone is not lethal but when it is given to infected mice, many die within a period of 8 hr, long before the control mice show

TABLE 1

NUMBER OF MICE SURVIVING EXPERIMENTAL TREATMENT AT TIMES DESIGNATED

Time in hours from beginning of experiment	Mice inoculated with *S. typhimurium* and injected at intervals of 1 hr with:		Mice not infected but injected at intervals of 1 hr with
	8 × 20 mg malonate in 0.5 ml saline	8 × 0.5 ml saline	8 × 20 mg malonate in 0.5 ml saline
0	20	20	15
4	20	20	15
5	18	20	15
6	15	20	15
7	11	20	15
8	8	20	15
24	1	20	15
48	0	19	15
72		5	15

[1] This study was supported at Bryn Mawr College by funds provided under contract AF 33 (038) 17842 with the USAF School of Aviation Medicine, Randolph Field, Texas.

[2] We acknowledge with gratitude the technical assistance of Claire Liachowitz, Margaret Jones, and Elenore Schewe.

any signs of illness. This synergism between bacteria and metabolic inhibitor has been confirmed in several duplicate experiments not only with the same pathogen and inhibitor but with other pathogens and poisons as well. These results have broad implications for the phenomenon of parasitism and should be investigated from a variety of approaches. More detailed reports are in press.

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Identification of Glycogen in Whole Bacterial Cells by Infrared Spectrophotometry

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A recent report of infrared spectra of intact bacterial cells indicated that some of the bands could be interpreted as protein, nucleic acid, and polysaccharide absorptions (*1*). Subsequent work has shown, in addition, that a glucan of the glycogen-starch type can be identified in spectra of whole cells. This glucan was isolated and proven to be glycogen.

Absorption bands at 8.7, 9.25, and 9.75 μ were observed in the spectra of dry films of enteric bacteria grown on nutrient agar with added carbohydrate. When the growth medium lacked the carbohydrate, only the 9.25-μ band was observed in this spectral region (Fig. 1). The effect of the carbohydrate on the bacterial spectrum was more pronounced when cultures were incubated at 15–20° C rather than at 37° C. The additional absorption bands at 8.7 and 9.75 μ, when weak, appeared only as inflections on the sides of the 9.25-μ band, whereas, when strong, they were accompanied by a deepening of the 9.25-μ band and the appearance of new absorptions at 10.75, 11.8, 13.2, and 14.2 μ.

In an attempt to find the origin of this group of absorption bands, cells of *Aerobacter aerogenes* grown at 15–20° C for 2 days on nutrient agar (Difco) with 1% glucose were subjected to chemical fractionation; infrared spectrophotometry was used to follow the course of the procedure (Fig. 1). Since aqueous extraction failed to remove the characteristic bands from the bacterial spectrum, the cells were disintegrated by sonic vibrations (10 kc). After the debris was removed by centrifugation, infrared spectra showed the desired material in the opalescent supernatant. It was found to be precipitable by 1 volume of 95% ethanol, and the spectra revealed that successive reprecipitations caused progressive attenuation of the 6.05- and 6.45-μ bands which can be attributed primarily to protein. The last traces of protein were removed by shaking with chloroform and isoamyl alcohol. After this treatment the spectrum had no band at 6.45 μ and only a weak band at 6.05 μ, the latter probably due to residual water. The spectrum of the final product showed the characteristic bands at 8.7, 9.25, 9.75, 10.75, 11.8, 13.2, and 14.2 μ, and it was identical with the spectrum of a commercial glycogen preparation. The

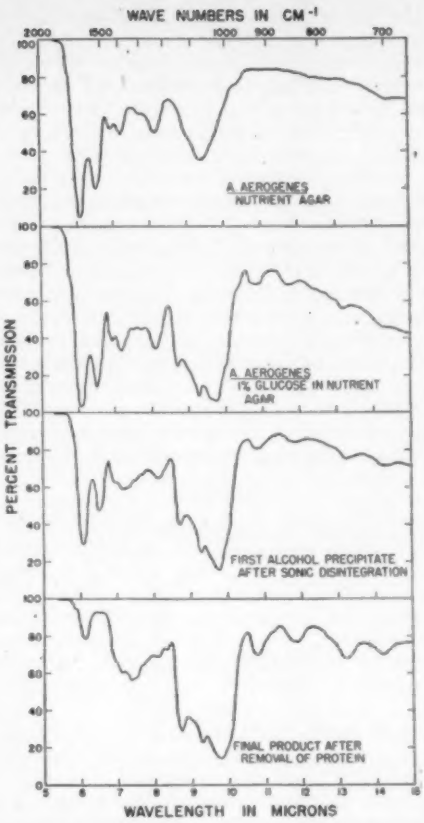

Fig. 1. Infrared spectra showing presence of glycogen in glucose-grown cells.

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product gave a reddish-brown coloration with iodine which is typical of glycogen.

The spectra of whole cells can now be used to follow the course of glycogen production and destruction under various conditions of growth. The amount of this polysaccharide in the bacterial cell can be estimated from the intensity of the 9.75-μ glycogen band. This is compared to the 6.45-μ protein absorption band which acts as an internal standard. The method has the following limitations: the absorption of small amounts of glycogen may be masked by bands due to other materials, particularly slime-layer or capsular polysaccharides; and the spectrum of glycogen resembles closely the spectrum of starch or dextrin. The advantages of the method are that it is rapid and simple, it involves no chemical manipulations, and it requires very small samples (as little as 0.4 mg of dried cells) (*2*). Later observations on the occurrence of glycogen in bacteria, as well as chemical and ultracentrifugal studies of this polysaccharide, will be reported.

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Micro Determination of Isoniazids in Blood

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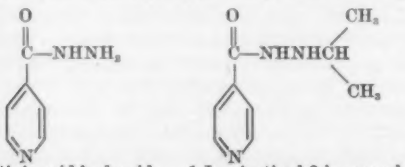
Compounds like isonicotinic acid hydrazide and the isopropyl derivative of isonicotinic acid hydrazide (1-isonicotinyl-2-isopropyl hydrazine) have been approved for use in the treatment of tuberculosis under medical supervision by the U.S. Food and Drug Administration. Accurate and sensitive methods for the determination of these compounds in blood would be valuable in following the course of treatment. Such methods have been proposed by Rubin *et al.* (*1*) and by Kelly and Poet (*2*). These methods are, however, cumbersome and do not lend themselves readily to the ordinary techniques of a clinical laboratory. The monaqueous titration method of Alicino (*3*) and the iodometric methods of Canbäck (*4*) and of Alicino are not applicable.



Isonicotinic acid hydrazide

1-Isonicotinyl-2-isopropyl hydrazine

The following method is simple and more rapid than the methods mentioned. It depends upon the reduction of potassium ferricyanide in acid solution by the isoniazid with the subsequent formation of a Prussian or Turnbull's blue and the colorimetric estimation of the greenish color formed from the yellowish of the ferricyanide and the blue of the iron complex compound.

Reagents. Sodium tungstate solution, 10%: Dissolve 10 g of reagent grade, carbonate-free sodium tungstate, $Na_2WO_4 \cdot 2H_2O$ in water and dilute to 100 ml.

Sulfuric acid, 2/3*N*: Tare a 50-ml beaker. Weigh into this beaker 35 g of concentrated sulfuric acid, specific gravity 1.84. Place approximately 500 ml of distilled water into a liter volumetric flask. Pour the sulfuric acid carefully into the liter flask containing the water, while swirling the flask. Cool, complete to volume, and check the normality against standard sodium hydroxide solution. Adjust the concentration, if necessary.

Acetic acid 3*N*: Prepare in the customary manner.

Potassium ferricyanide solution: Dissolve 2 g of analytical, reagent grade potassium ferricyanide, $K_3Fe(CN)_6$, in distilled water and dilute to 500 ml. Store in a brown bottle protected from light and preferably under refrigeration. Transfer small volumes to another brown bottle for daily use or prepare a fresh solution, as desired.

Standards may be conveniently prepared using recrystallized 1-isonicotinyl-2-isopropyl hydrazine phosphate or isonicotinic acid hydrazide and normal horse serum or pooled normal human blood plasma.

Standard isoniazid solutions: Weigh carefully 0.200 g of isoniazid and transfer to a 200-ml volumetric flask. Add distilled water, shake until dissolved, and dilute to volume. This is the stock standard solution and contains 1 mg/ml.

Transfer with the aid of a volumetric pipet 1 ml of the stock standard solution to a 50-ml volumetric flask and dilute to volume with distilled water. This solution contains 20 μg/ml.

Standard curves: Transfer with the aid of pipets 0.5, 1.0, 1.5, 2.0, 2.5, 3.0, 3.5, and 4.0 ml of the diluted standard isoniazid solution containing respectively, 10, 20, 30, 40, 50, 60, and 80 μg of isoniazid to 1 ml of normal horse serum or pooled normal human blood plasma. Dilute to 6 ml with distilled water and proceed with the method as detailed below. Since only 4 ml of the tungstate filtrate is used, the standard curve represents half the concentrations listed above, namely, 5, 10, 15, 20, 25, 30, 35, and 40 μg, respectively.

Transfer 1 ml of blood plasma to a 16 × 150-mm test tube. Add 5 ml of water, mix; add 1.0 ml of 10% sodium tungstate solution and mix with an individual glass rod; add 1.0 ml of 2/3*N* sulfuric acid, mix with an individual glass rod, and place the tubes in a water bath at 80–85° C for 1 min to coagulate the precipitate. Remove the tubes from the hot bath, chill in a cold water bath, dry the outside of the tubes, and filter

through a 9-cm Schleicher and Schuell No. 576 filter paper.

Transfer 4 ml of the clear filtrate to a Klett-Summerson colorimeter tube or other tube, add 0.5 ml of 3*N* acetic acid, and mix by swirling; add 0.5 ml of potassium ferricyanide solution, and mix again by swirling. Place the tubes in a hot water bath at 80° C for 15 min. Remove the tubes from the bath, cool under running water, or place momentarily in an ice bath and read 25 min after initial immersion in the heating bath, in a Klett-Summerson photoelectric colorimeter using a No. 66 filter. Compare against standards treated similarly at the same time or use a prepared curve. Multiply the result by 2 to get the micrograms of isoniazid per milliliter of blood plasma.

The method was tried using human blood plasma[1] and serum, normal horse plasma,[2] and normal sheep plasma because these were available. Over 150 such samples were tested and all were negative or virtually so under the conditions of the test.

Known volumes of standard solutions of the purified phosphate of the isopropyl derivative of isonicotinic acid hydrazide (1-isonicotinyl-2-isopropyl hydrazine phosphate), Marsilid[3] phosphate, and of purified isonicotinic acid hydrazide, Rimifon,[3] were added before and after tungstate-acid treatment.

Representative results obtained by use of this method with known amounts of added Marsilid phosphate to blood plasma samples are, in micrograms and Klett-Summerson scale readings respectively: 0, 0; 5, 21; 10, 37; 15, 42; 20, 64; and 25, 98. These results indicate that the method can be used for the determination of isoniazid in blood in the order of 4–5 μg and up.

The theoretical aspects, accuracy, precision, and sensitivity of this method have been discussed in another paper (*5*). In that paper it was pointed out that the concentration of acid, the temperature, and the isoniazid in question have a pronounced effect on the sensitivity of the reaction. When the original method of assay, using a boiling water bath and hydrochloric acid for the ferricyanide reduction step, was applied to blood, occasional samples of human plasma known not to contain isoniazids, reduced the ferricyanide. This interference was eliminated when hydrochloric acid was present by increasing the acid concentration of the final reaction mixture from approximately 0.1*N* to approximately 0.3*N* and by reducing the temperature of heating from 99–100° C to 79–80° C. The reduction in heating temperature necessitated increasing the heating period from 5 min to 15 min. The heating period at 80 ± 0.5° C should be kept to 15 min. The overall heating time from 75 to 80° C may be 20 min. When acetic acid was used, however, the reduction could be carried out at 100° C.

The reduction of ferricyanide as a method of determination has been applied in various ways, possibly the best known clinical application is that of the determination of glucose (*6–8*). The glucose method, however, is performed in alkaline solution generally in the presence of cyanide-carbonate solution. The ferricyanide method detailed here is performed in an acid solution. Under these conditions glucose does not interfere nor do the normal components of blood.

Poor results were obtained when trichloroacetic acid was used as the protein precipitant. While better precipitation was obtained with hexametaphosphoric acid than with tungstic acid, the sequestering action of the hexametaphosphoric acid prevented the formation of the Prussian blue.

An attempt was made to adapt this method to the determination of isoniazids in urine but anomalous results were obtained even when the heating temperature was lowered to 65° C and the final acid concentration was increased to over 1*N*. Work is continuing on this variation.

Since the method described in this paper is an empirical method, one should adhere closely to the procedure as detailed, paying close attention to the acid concentration, the time of heating, prompt cooling, and prompt reading. The analyst may, however, vary conditions to suit his needs but then must prepare standard curves conforming to the changed conditions or must carry along standards using the changed conditions.

[1] The human blood plasma was obtained from samples submitted for typing to the Rh Laboratory of the Bureau of Laboratories, Dept. of Health of New York City.

[2] The normal horse plasma and normal sheep plasma were obtained from the Research and Antitoxin Laboratory of the Bureau of Laboratories of the Department of Health, City of New York, at Otisville, N. Y., where much of the work was performed.

[3] Trade name of Hoffmann-La Roche, Inc.

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Comments and Communications

Comment on Flying Saucers

I WOULD like to call to the attention of your readers that the entoptical theory of E. F. Mauer (SCIENCE, 116, 693 [1952]) that the flying saucers may be spots before the eyes, is untenable.

If such a theory would be correct, one would expect a more or less even geographical distribution of the sightings, expressed—say—in terms of sightings per million population per year.

From the declassified version of an Air Force Report, it is possible to find the geographical distribution of the sightings, and this indicates that the distribution is not uniform, but shows definite maxima in certain regions of the country. This is definitely not in agreement with any entoptical interpretation.

LEON DAVIDSON

Arlington, Virginia

Received May 24, 1953.

A Single Tube Method for Anaerobic Incubation of Bacterial Cultures[1]

PREVIOUSLY described methods for obtaining anaerobiosis in culture tubes either require that the tube be inverted or that accessory equipment be used (*1*). By the procedure reported here, it is possible to obtain anaerobic conditions in individual tubes without the use of special media or apparatus. This method has been found especially applicable when it is desired to follow the progress of anaerobic growth in broth by turbidimetric procedures.

A ⅝ by 6 in. culture tube containing up to 10 ml of medium is stoppered with a cotton plug rolled tightly around a small vial, as shown in Fig. 1A. These tubes can be inoculated in the usual manner, and will permit normal aerobic growth. When anaerobic conditions are desired, the cotton plug is pushed down into the culture tube until the top of the vial is below the lip of the tube. Two milliliters of 40% KOH and 2 ml of 20% pyrogallol are pipetted into the vial. Immediately after addition of the second reagent, the mouth of the tube is flamed lightly, and a rubber stopper, previously coated with paraffin, is inserted. The stopper is held firmly in place for a few seconds until the tube cools and the paraffin hardens to form a seal (Fig. 1B).

Experiments have shown that the anaerobiosis is complete and fairly rapid. When incubated in this manner, facultative organisms do not grow on media which support aerobic but not anaerobic growth. *Aerobacter aerogenes,* for example, will grow aerobically but not anaerobically on synthetic medium containing lactate as sole carbon source. Methylene blue indicator solution (*1*) in such tubes is visibly reduced after a few minutes and totally decolorized in two hours.

[1] The writer is a Public Health Service Research Fellow of the National Institutes of Health.

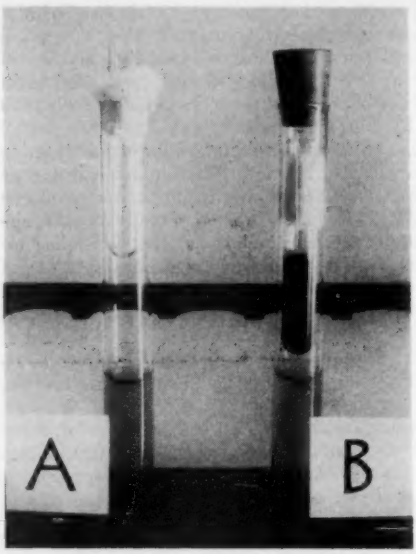

FIG. 1. Single tube for aerobic or anaerobic growth. A, aerobic conditions; B, anaerobic conditions.

Rapid attainment of anaerobic conditions may be improved by folding accordion-wise a strip of filter paper slightly longer than the inner vial and placing it in the vial to provide greater surface for oxygen adsorption.

WILLIAM R. LOCKHART

Department of Biological Sciences
Purdue University

Reference

1. SOCIETY OF AMERICAN BACTERIOLOGISTS. *Manual of Methods for Pure Culture Study of Bacteria* (Leaflet III). Geneva, N. Y.: Biotech. Publ. (1952).

Received November 21, 1952.

Pain—Controlled and Uncontrolled

THE sources of the disagreement expressed in the two communications on the subject of pain by Henry K. Beecher and by Hardy, Wolff, and Goodall (SCIENCE, 117, 164 [1953]), can be seen to arise from certain errors on both sides. Dr. Hardy and his group base their arguments upon studies in which they have been attempting to measure accurately the pain that arises under controlled experimental conditions, when normal healthy tissues are exposed to a noxious stimulus. They have failed to recognize that the pain they are measuring is fundamentally different from that pain which originates within tissues whose metabolism has become deranged through damage or disease, and thus constitutes a sign of existing injury.

On the other hand, Dr. Beecher has approached the problem at the clinical level but has confused the issues by insisting upon an artificial distinction be-

tween what he terms, "experimental" and "pathological" pain. Many observers have recognized that two different types of pain exist, and have sought to define them in various ways. Thus we find reference in the literature to deep and superficial pain, cutaneous and visceral pain, epicritic and protopathic pain, etc. Recognizing the dichotomy of pain, none of the suggested definitions has proven satisfactory. Dr. Beecher's separation is inaccurate and does not contribute toward a better understanding of the problem. As Dr. Hardy and his co-workers point out, Dr. Beecher has classified pain on the basis of the psychic response engendered by the particular circumstances under which the pain is experienced (i.e., in the laboratory or in the hospital bed). His use of the term experimental pain suggests that this is some sort of hothouse variety that has to do only with scientific inquiry.

Several years ago, Dr. Revici and I suggested that pain be separated into two types, defined as physiological and pathological. The advantage of these terms in understanding the fundamental differences between the two types of pain has become increasingly apparent, and their general acceptance would resolve many of the semantic debates such as the one that appeared in SCIENCE.

Physiological pain is induced when noxious external stimuli are applied with sufficient intensity to healthy intact tissues, having specific pain end organs. Such pain is a sensorial sensation, similar in every respect to other sensations such as sight, hearing, taste, touch, etc., each of which has its own specific end organs as well as transmission pathways and centers of reception in the brain, and serves to provide the organism with information regarding its surroundings. Physiological pain serves as a warning signal to the organism that the stimulus applied represents a threat to its tissues. Using the means immediately at its disposal, the organism normally responds to physiological pain by fleeing from or fighting off the noxious stimulus in an effort to maintain the integrity of its tissues.

Pathological pain originates within tissues whose metabolism has been deranged as the result of damage or disease. Such pain is thus a sign of existing injury rather than a warning to the organism of impending danger. The impulses that give rise to pathological pain appear to be transmitted from abnormal foci along pathways ordinarily transmitting other sensations such as touch, cold, heat, and physiological pain, as well as by way of the autonomic system. The organism responds to pathological pain by endeavoring to place the injured part at rest in order to protect it and thereby facilitate recovery.

It is evident that physiological and pathological pain are fundamentally different in their origin, transmission, and significance to the organism as well as in the responses they arouse. In view of these basic differences, it is obvious that methods of study developed for one will not be satisfactory for the other. While physiological pain is readily investigated under the experimental conditions of the laboratory, using normal tissues, it is more than a laboratory reality. Pathological pain existing only in relation to diseased or damaged tissues is most effectively studied in subjects in whom such lesions exist. Our own studies have been concerned with the character of the metabolic changes within abnormal tissues that give rise to pathological pain.

ROBERT A. RAVICH

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Brooklyn, New York

Received March 5, 1953.

Book Reviews

Flying Saucers. Donald H. Menzel. Cambridge, Mass.: Harvard Univ. Press, 1953. 319 pp. Illus. $4.75.

In these days when we are regularly having our attention called to articles and books claiming that the flying saucers are interplanetary space ships and are receiving circulars offering for sale pictures, purporting to be photographs of flying saucers, it is refreshing to see a book which makes a sensible interpretation of the oft repeated stories.

Dr. Menzel begins with stories of "saucers" and strange lights since the present scare started in 1947. He shows the difficulty of explaining these old stories by pointing out that nearly all give estimated size and distance, although any trained person should know that he cannot tell how far away such an object is. He checked one story and found it necessary to change date, direction of motion, and other details. He gives another story as follows: ". . . on February 9, 1913. A great procession of slowly moving meteors moved diagonally across the United States and Canada, from Saskatchewan to Bermuda." This sensational story is based on nothing more than a fine shower of shooting stars in the Toronto area, a very few fireballs or shooting stars observed in other places, and practically nothing from the United States.

In spite of errors and exaggerations in the stories, Dr. Menzel gives plausible, although not always complete, explanations, for all reports discussed. He makes considerable use of mirages, sundogs, and other phenomena of meteorological optics, and devotes several dozen pages and some notes in the appendix to these phenomena. On the much advertised green fireballs, he comments, correctly, "Any astronomer who avers that green meteors are new, or that the color must come from burning copper, cannot be much of an authority."

Readers will find the pages on hoaxes, and on the

"Strange signes from Heaven" observed before the present scare, well written and interesting. On these earlier sightings, Dr. Menzel goes back to the vision of the four living creatures in Ezekiel. He points out that the ghosts of radar are essentially mirages, and that they had caused considerable trouble during World War II. He closes the book with speculations on space travel and instructions on what to do if one sees a flying saucer.

A point which I would emphasize, more than Dr. Menzel has, is that nearly all reports telephoned to me, and using the word, "saucer," have been found to refer, certainly or probably, to the brilliant spot of sunlight reflected by a metal plane, and observed from the critical angle. Of course, I am asked to explain plenty of other phenomena such as mirage effects, but the observers do not call these "saucers." I would also emphasize that if a real space ship or enemy missile should appear over the U.S., the numerous reports would make available plenty of data for calculated figures on path, height, and speed, instead of the meaningless guesses now being published.

C. C. WYLIE
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State University of Iowa

Physiological Foundations of Neurology and Psychiatry. Ernst Gellhorn. Minneapolis: Univ. Minnesota Press; London: Geoffrey Cumberlege, Oxford Univ. Press, 1953. 556 pp. Illus. $8.50.

Integration of what is known of the basic physiology of the neuron and neuronal groups or networks, with the factors involved in the problems of nervous and mental disease, is a combination of the greatest hope and despair for all investigators in these fields. For this reason, even if there were no others, an effort to perform that integration (in the present meager state of our knowledge) by as eminent a neurophysiologist as Dr. Gellhorn, will be of unquestionable interest to anyone involved with the complexities of the nervous system and its role in the total behavior and maintenance of the living organism.

Many problems and functional levels are discussed under the six following primary groupings: (1) intrinsic and extrinsic factors regulating neuronal activity; (2) contributions to the physiology and pathology of movements; (3) the physiological basis of consciousness; (4) some aspects of autonomic physiology; (5) integrations; and (6) applications.

These major divisions allow the author to include a wide variety of topics in his discussion, covering subjects from the Adrian-Bronk law, electromyography, convulsions and consciousness, to autonomic activity, conditioning, and some physiological concepts relating to mental disease and therapy. In general, the author has discussed a certain number of problems of interest to him (and to which he has contributed during his many fruitful years of investigation) and has tried to find logical places for them in the over-all picture of organismal activity. This necessitates, of course, a certain bias both in commission and omission and leaves much room for controversy. It might not have been amiss to start the title of the book with the word "Some" and to have altered the word "Foundations" to "Correlates."

A great deal of valuable factual information is presented here, so much that one feels somewhat fearful, in a sense, of belittling it. Nonetheless, the feeling is inescapable that many important factors have been slighted in favor of the hypothalamic-cortical system, even in areas where they would fit into the picture the author is trying to create. For example, recent work relating to the role of rhinencephalic structures in emotion and behavior is greatly underplayed. Many of the new findings concerned with the functions of the hippocampus, fornix, cingular gyrus, amygdala, and other associated areas are of the greatest importance not only in our general considerations of emotion and behavior, but also in regard to our understanding of the "autonomic" nervous areas and functions. So much of this work raises new possibilities that one can no longer comfortably envision the hypothalamus as the answer to the neurophysiological maiden's prayer—most certainly *not* if it is being discussed just as its role as an autonomic center. Such centers are too widespread in the central nervous system to allow any one of them completely to overshadow all the others, especially those which have been shown to be of the first importance in somato-visceral integration and correlation.

If it seems unphysiological to suggest one of many interrelated neuronal groups as a multifunctional center of far more importance than other associated groups, in the same way it does not seem completely sound to suppose that the reactions to various stimuli to which the whole organism is subjected can be interpreted by constant reference to any one center. To be sure, certain things will affect the hypothalamic-cortical relationships and this is a part of the whole that must be taken into account, but there is no obvious reason for making this particular relationship more important, let us say, in trying to explain the effects of shock therapy, than bulbo-reticular thalamo-cortical interrelations, or generalized somato-visceral correlations, or changes in permeability of neuronal surfaces, etc., almost ad infinitum.

Lack of space prevents complete discussion of many other problems arising from this type of presentation, such as some questionable views concerning the theory of carbon dioxide therapy, and the interpretation of results obtained with the oxygen electrode. In contrast to these are some highly stimulating expositions of problems of convulsive activity, consciousness, and homeostasis. The entire book is a most provocative one despite its limitations and will serve physiologists, neurologists, psychiatrists, and others as a summary of much of the material now in the forefront of investigation of the nervous system.

ROBERT G. GRENELL
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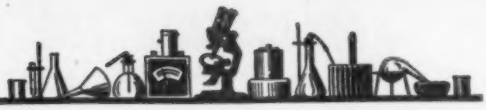

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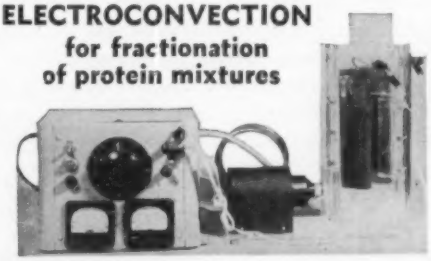

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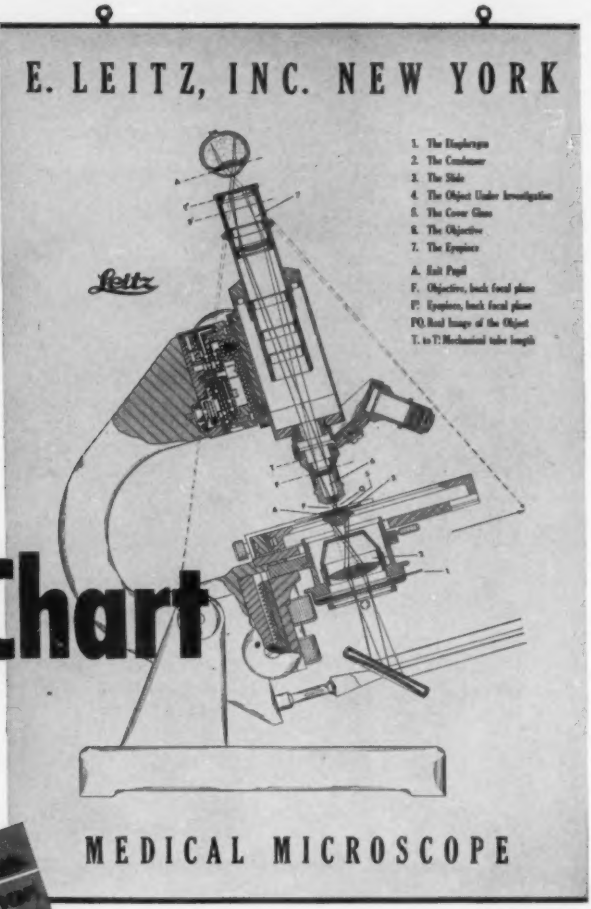

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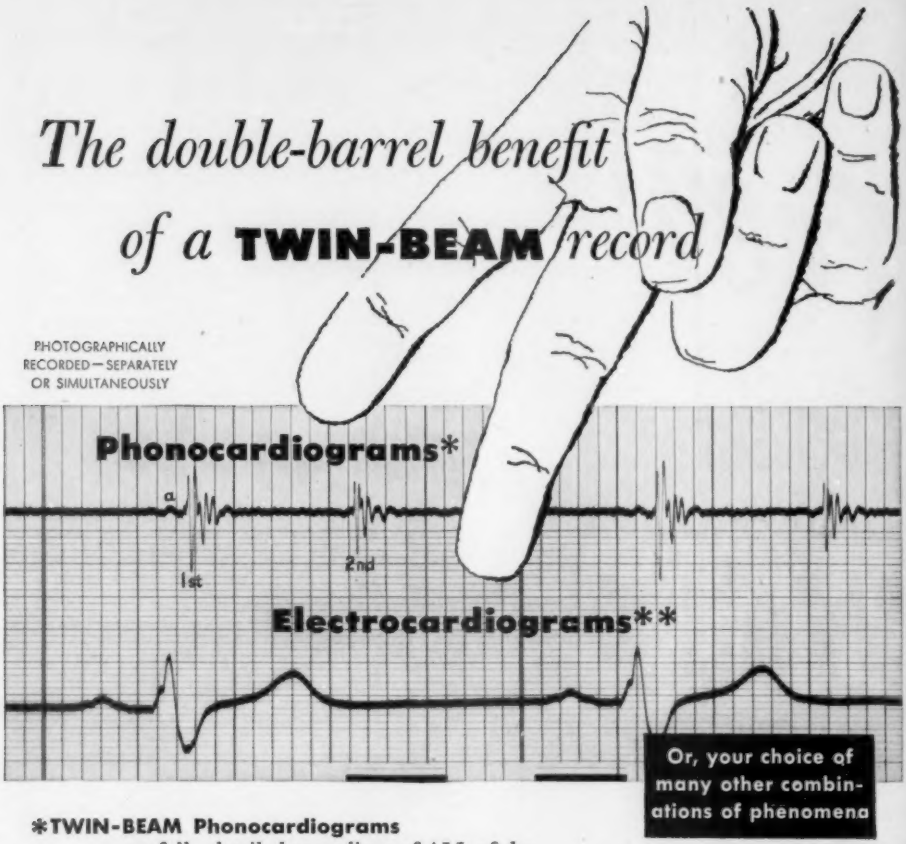

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